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ELECTRICAL RESISTANCE SPOT WELDING CONNECTION: PRECAUTIONS FOR THE REPAIR



Note, one or more warnings are present in this procedure



Special tooling required	
Kit for checking weld seams.	Car. 1779
Set of replacement test pieces for tool Car. 1779	Car. 1800

1. INTRODUCTION

1-PURPOSE

the purpose of this document is to provide the information necessary for making quality resistance spot welds by describing the procedure to apply to define the correct RSW weld parameters. To this end, it includes:

- Weld pre-adjustments adapted according to the thickness and grade of the steel to be welded (mild steel, high elastic limit, very high/ultra high elastic limit).
- Peeling test.

This test alone confirms the weld parameters (Current; Time; effort) and guarantees the result in terms of the quality of the repair.

This is a destructive test from the original assembly tests; it is based on the diameter of the material rivet on pulling.

Note:



This procedure is to be used before every weld according to the stack (grade/thickness).

2- PROCEDURE

- Consult the vehicle MR: **section II.**
- Consult the charts with the procedure for defining the reference panel (2 and 3 thicknesses): **section III.**
- Perform the peeling test: **sections IV and V.**

- Interpret the results: **section VI.**
- Use the remedial procedures: **section VII.**
- Use the replacement solutions: **section VIII.**
- Tests and checks on the vehicle: **section IX.**

3- DEFINITION CONDITIONS OF THE TABLES

The steel selected is representative of the majority of the stacks found in collision repairs. There are 3 grades: mild steel, high elastic limit, very high/ultra high elastic limit each in two thicknesses, with a G10/10 galvanised treatment.

■ These pre-adjustments have been defined under certain conditions:

- electrical supply: **32 A time-lag circuit breaker graph D**
- air supply: **pressure of 6.5 bar**

The conditions in addition to the technological performance of the welders are essential to obtain a quality result.

- electrode holder length: **120 mm**
- electrode active surface diameter: **8 mm**
- using a welder with **INVERTER** technology

2. CONSULT THE VEHICLE'S MR

- consult the Vehicle's MR to find out the grades and thicknesses of the stack.
-

define the reference panel:

Two-panel stack : the thinnest in the stack.

Three-panel stack : when repairing, do not weld three panels at a time; assemble two panels, then the third.

Note:

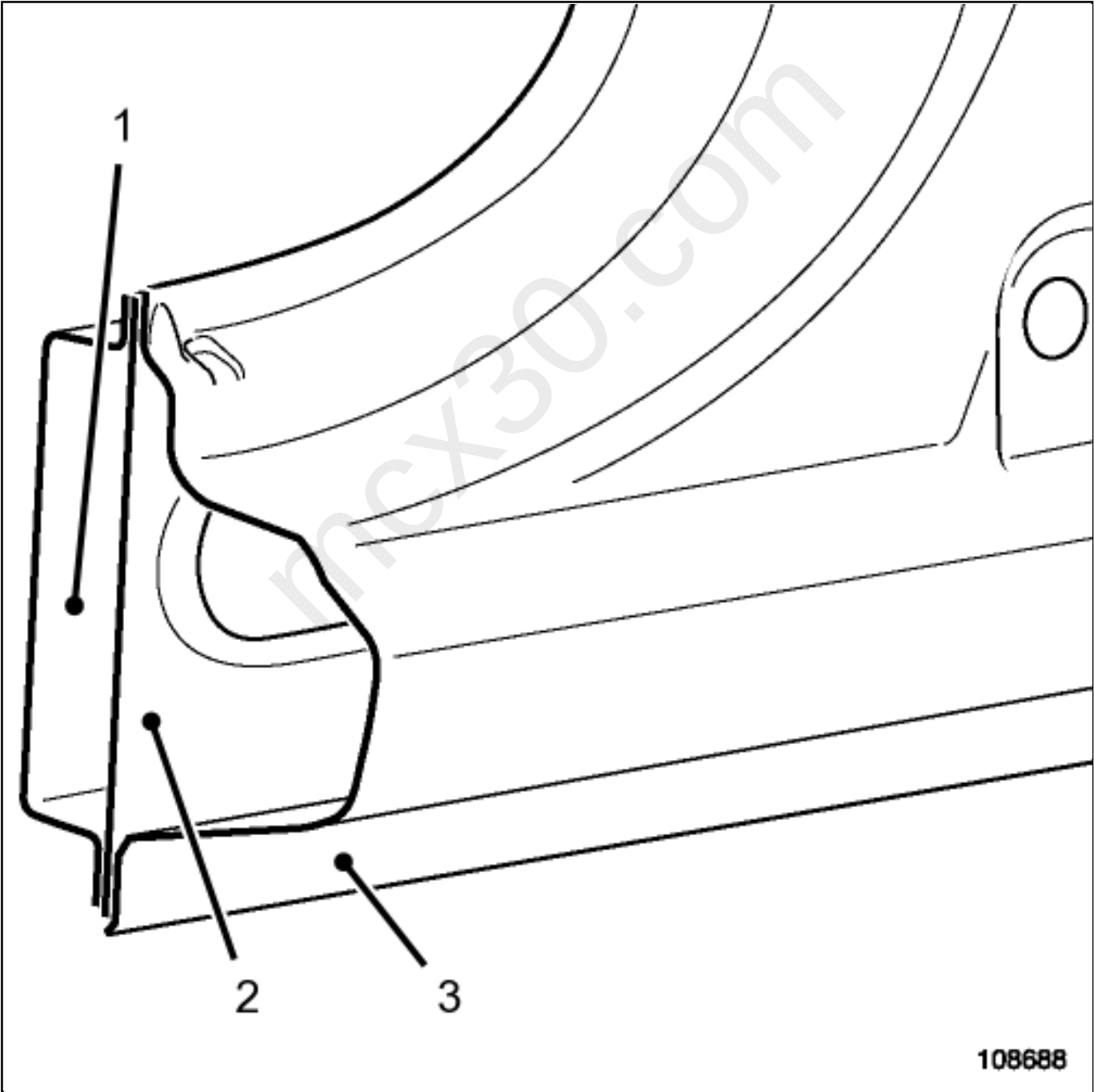


For the test to be valid, carry out exactly the same operations on the vehicle:

first weld two panels, then the third panel.

Example of three-panel stack:

No.	Description	Type	Thickness (mm)
(1)	inner sill panel	HLE	0.85
(2)	sill panel reinforcement	HLE	1.5
(3)	sill panel	Mild steel	0.75



The thinnest in the stack(1) of the first two panels assembled ((1) and (2)), then the third panel in the stack (3) .



Select the settings that correspond most closely to the grade and thickness of the reference panel, according to the table below.

3. TABLE OF PRE-ADJUSTMENTS

Note:



This chart should always be confirmed by a peeling test on samples according to the procedure explained in section IV.

1- CHART FOR HIGH CURRENT + SHORT TIME

Under optimal conditions short welds (high current; short time) are preferred.

Grades	Thickness of reference panel	Current (A)	Time (ms)	Effort (daN)
Mild steel	0.7 mm	11000	200	450
	1 mm	11500	200	450
HEL steel	0.85 mm	11500	250	450
	1.5 mm	12000	250	450
Very high/ultra high elastic limit steel	1 mm	12000	300	450
	2.5 mm	12500	300	450

WARNING



To avoid any accidents:



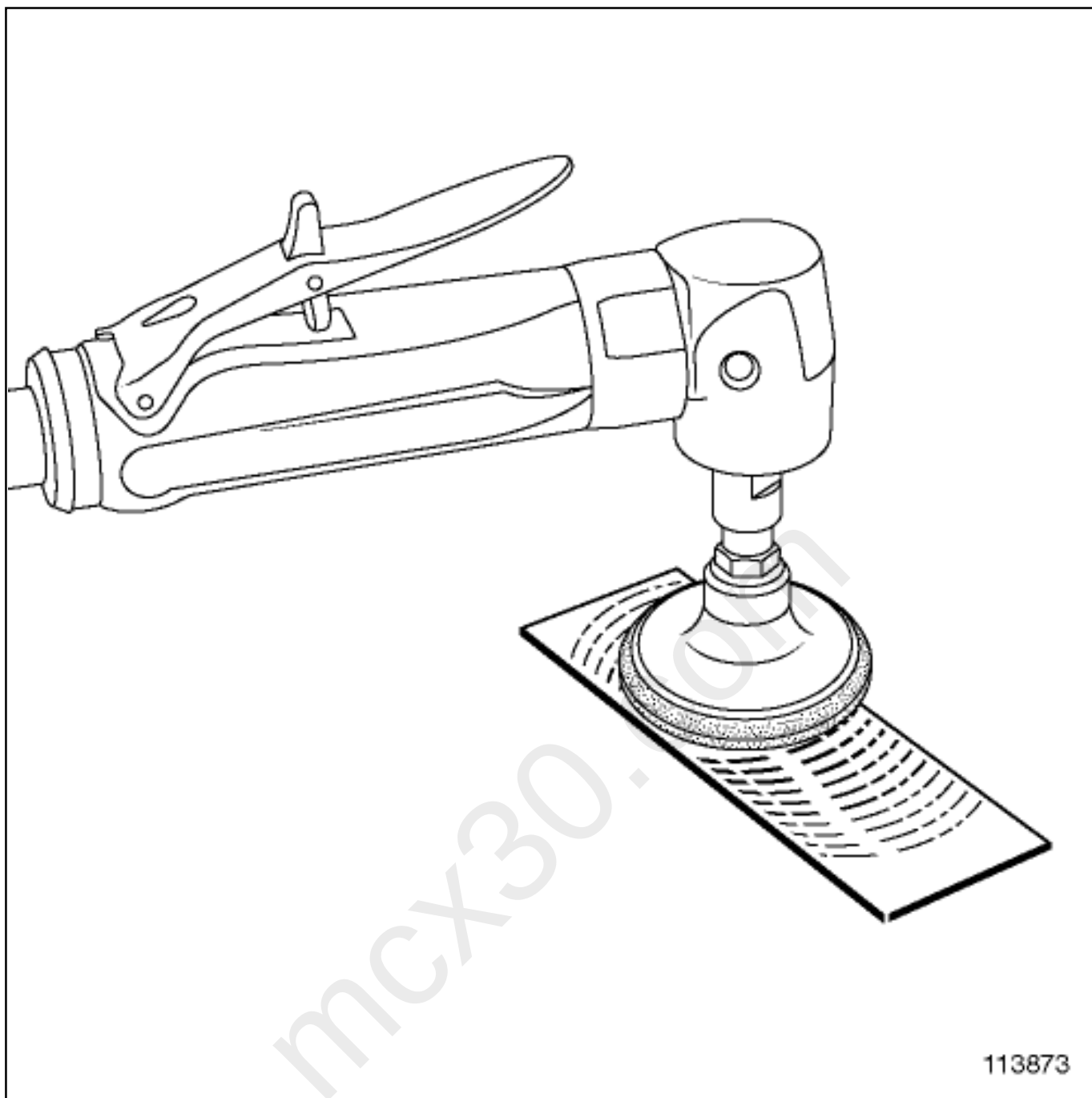
the vice used for the test should be correctly fixed to the workbench, and the workbench fixed to the floor,



when carrying out peeling, do not work in front of the tool, as the spot weld may suddenly give, or the jaw of the tool may slip from the test specimen.

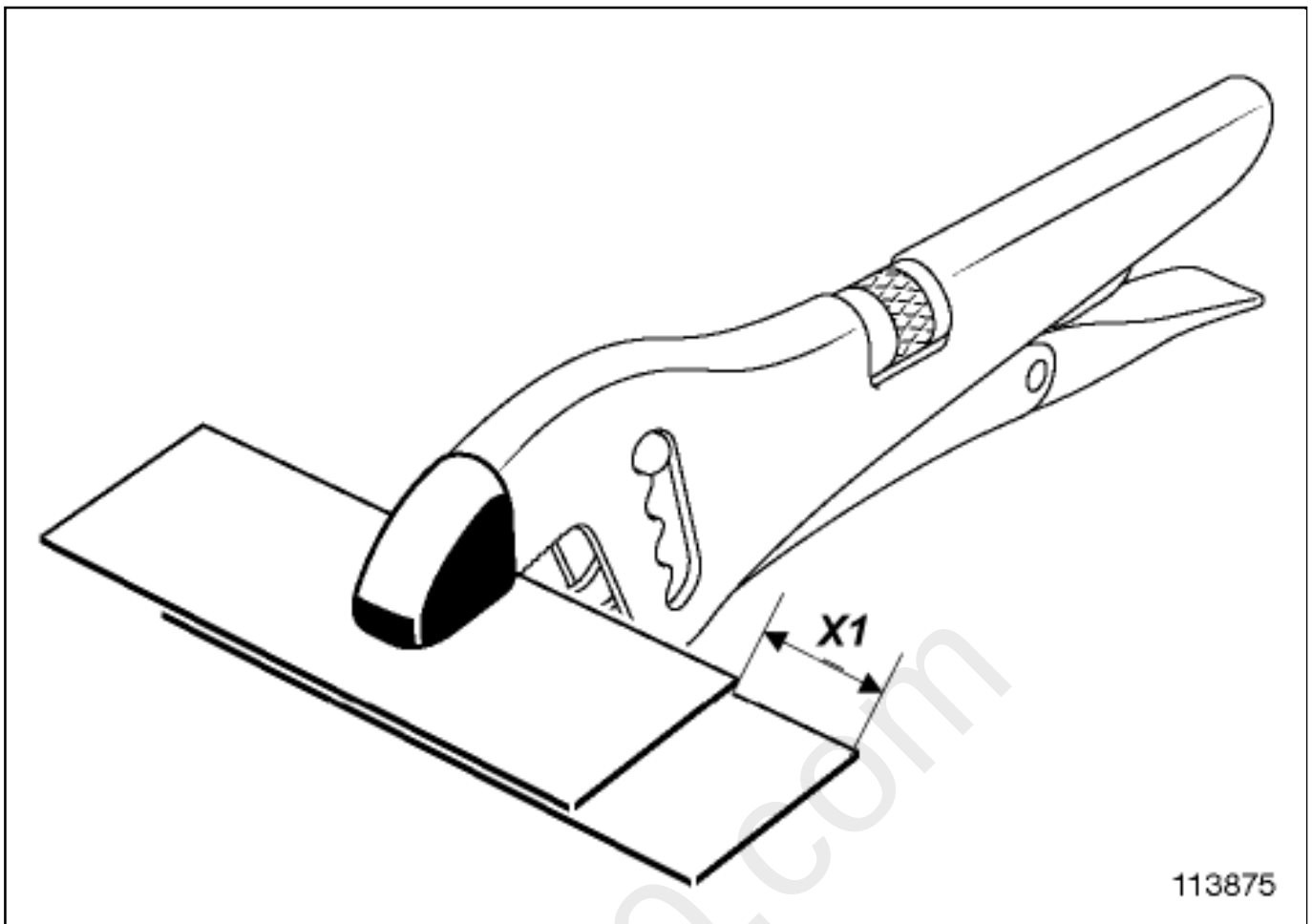


Use samples of the same steel grade and thickness as the stacks being tested (see vehicle MR) and the peeling toolKit for checking weld seams.(Car. 1779) or sets of replacement part test specimensSet of replacement test pieces for tool Car. 1779(Car. 1800) .



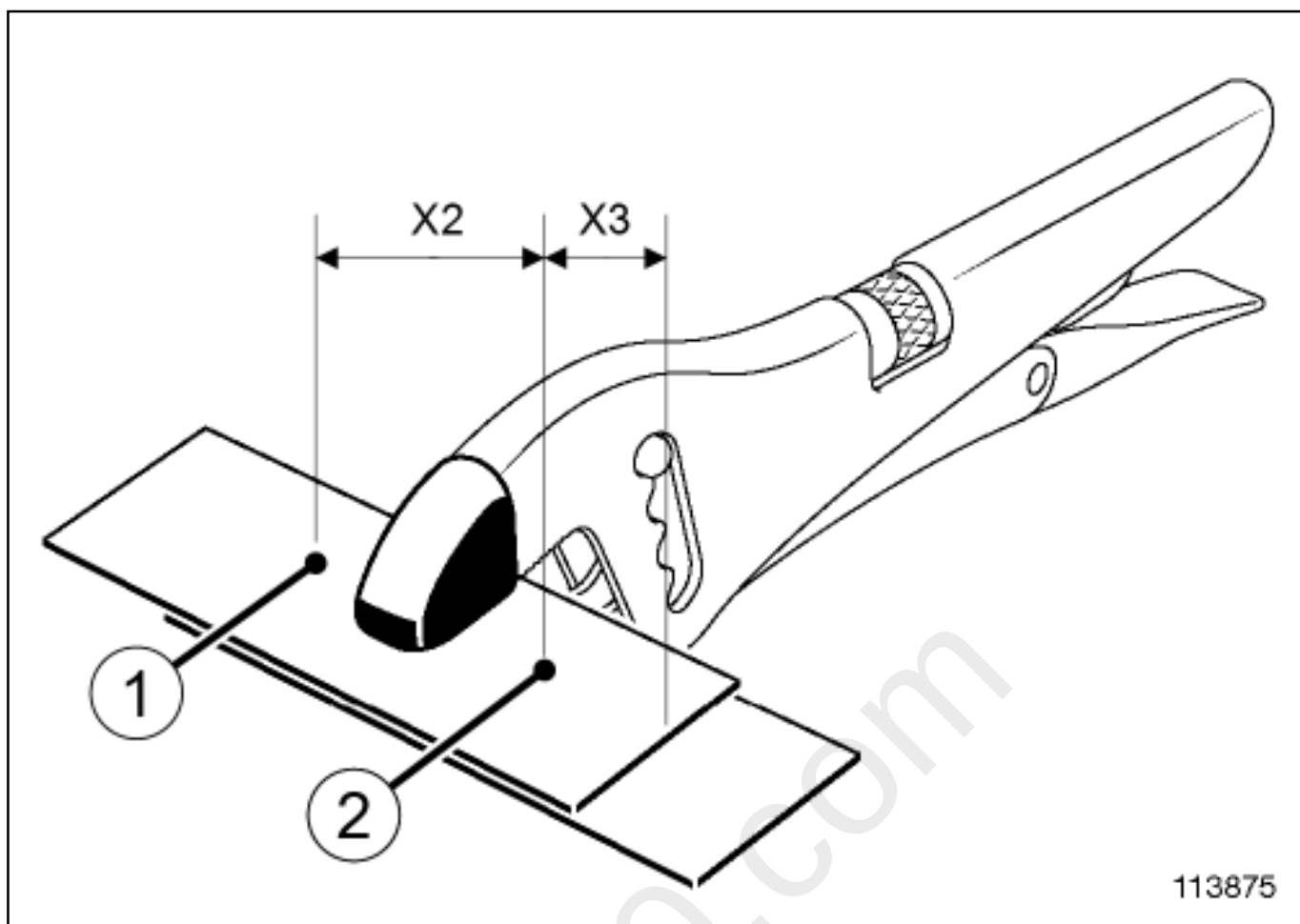
Prepare the test specimens in the same way as the vehicle .

(see 40B, Electrical resistance welded connections, Electrical resistance spot welding connection with direct access: Description)



Adjust the panel test specimens by staggering them by(x_1) = 20 mm.

Hold the joint in place using locking pliers at the insulated ends.



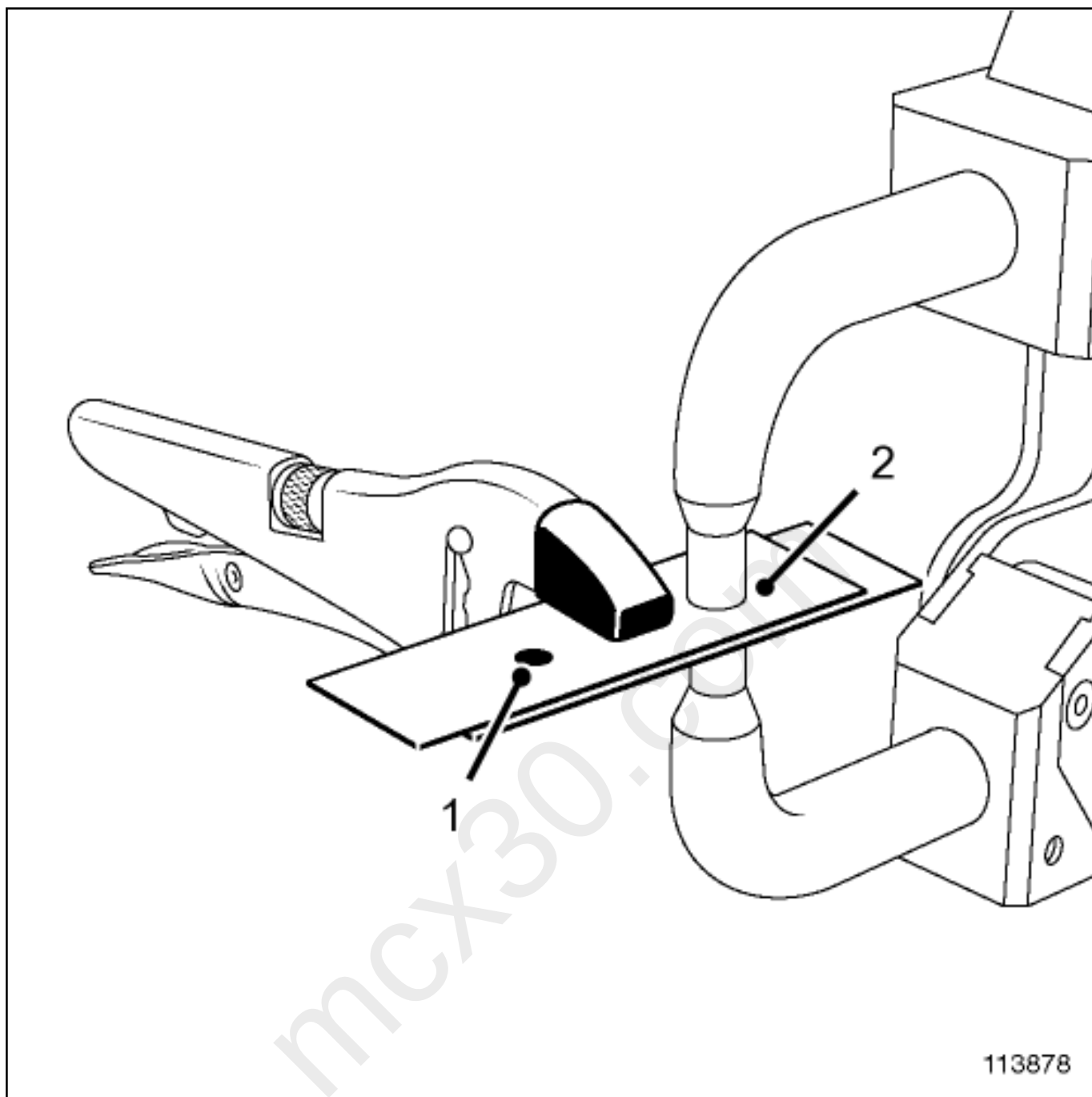
Mark the position of the two resistance spot welds(1) and (2) on the test specimen according to the following position values:



(x2) = 40 mm



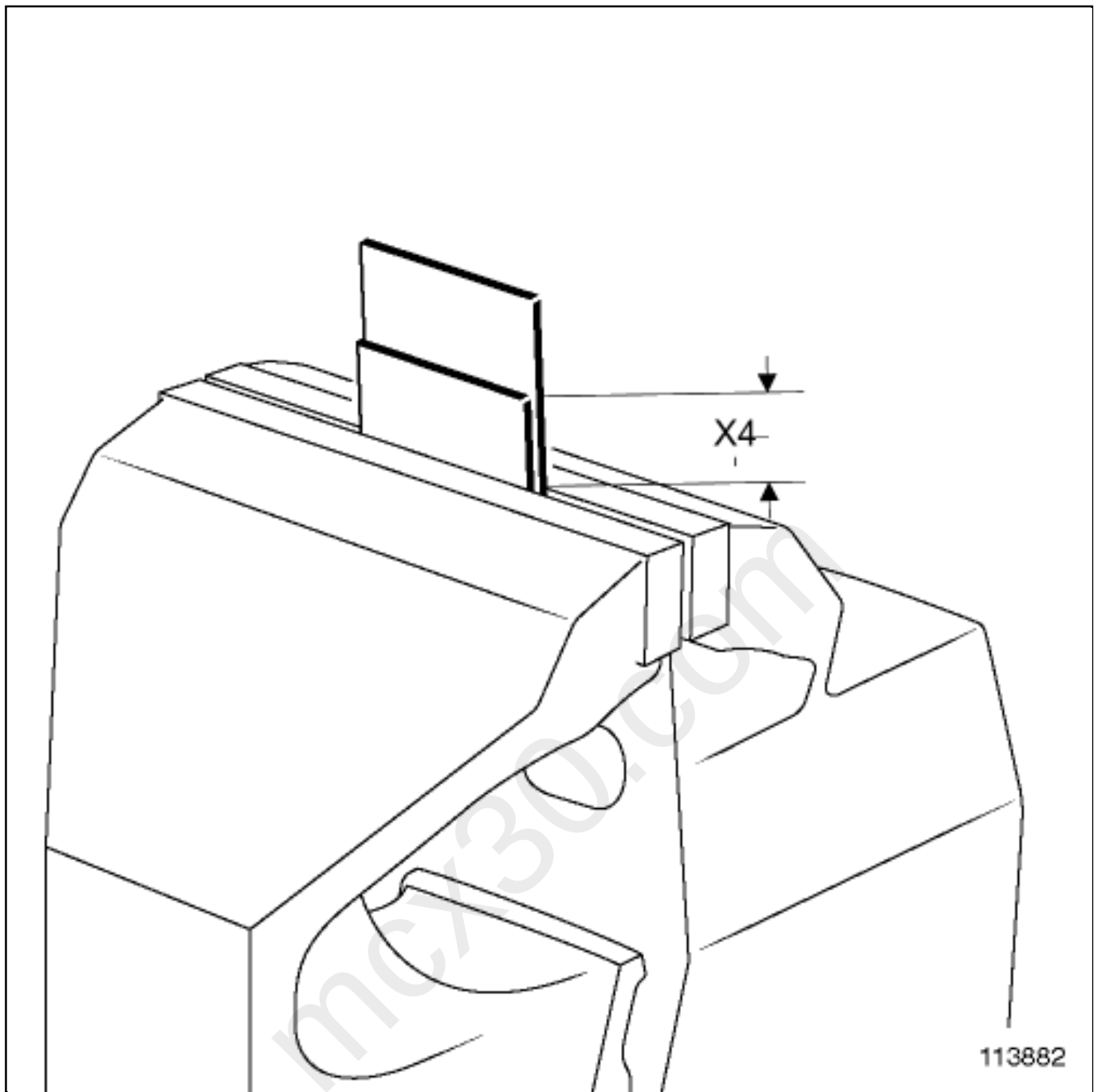
(x3) = 20 mm



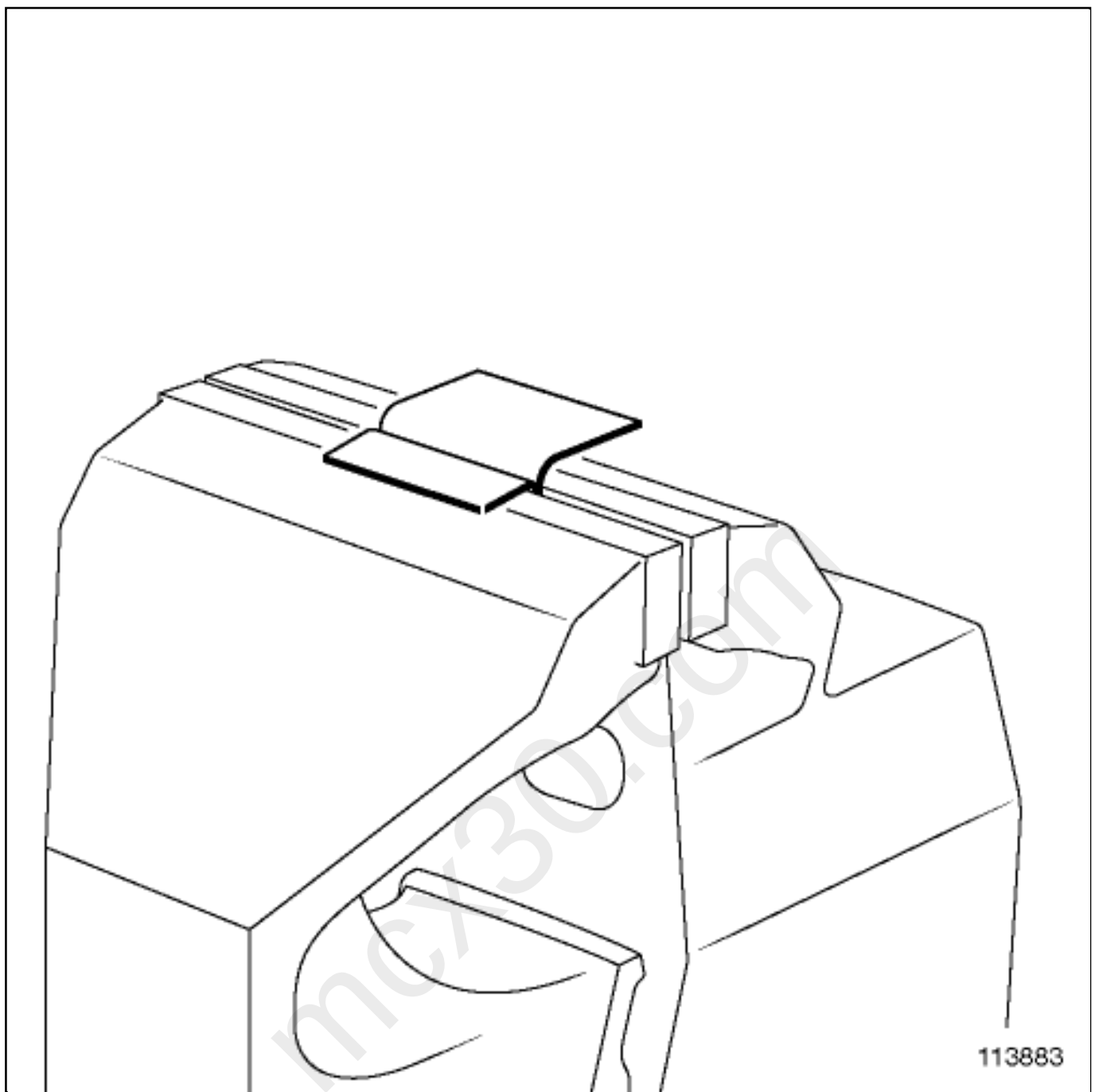
According to the adjustments defined according to the tables in section III.

Make the holding spot(1) ,

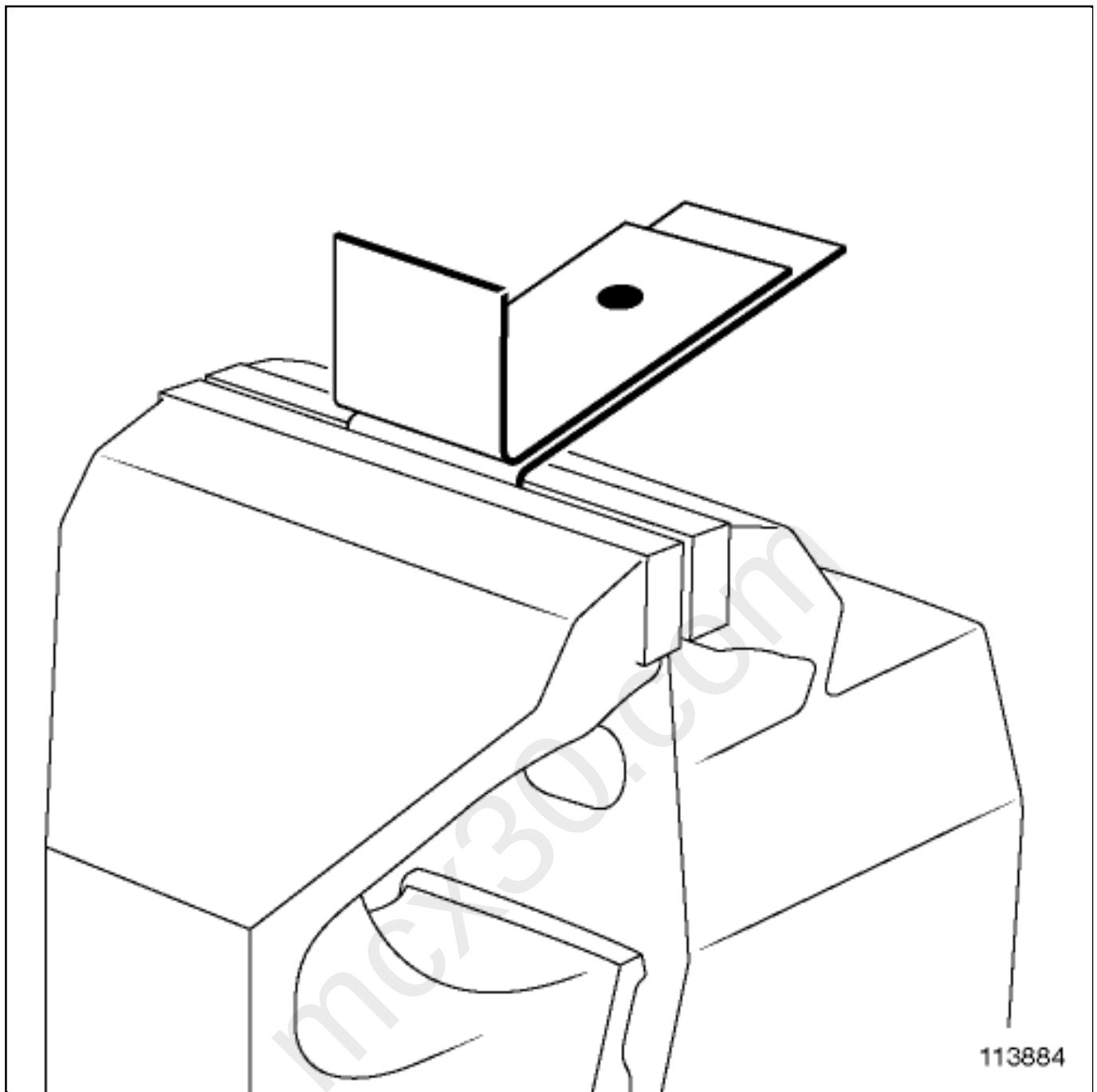
Make the peeling spot(2) .



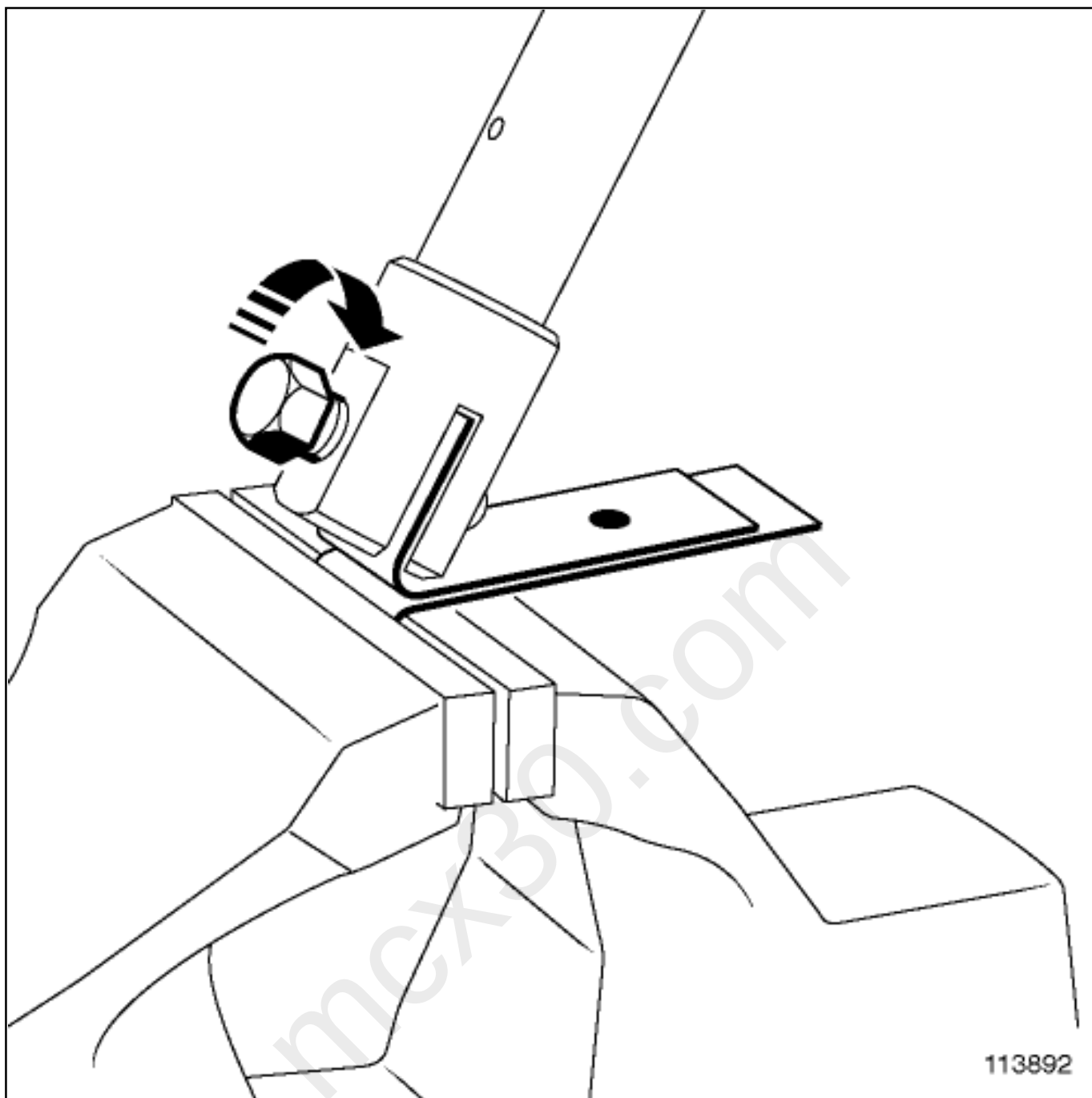
Secure the test specimens in the vice, respecting the value(x_4) = 15 mm shown in the illustration, to avoid damaging the spot weld during the following stage.



Fold down the two panel test specimens.



Secure the test specimens in the vice again as shown in the illustration.

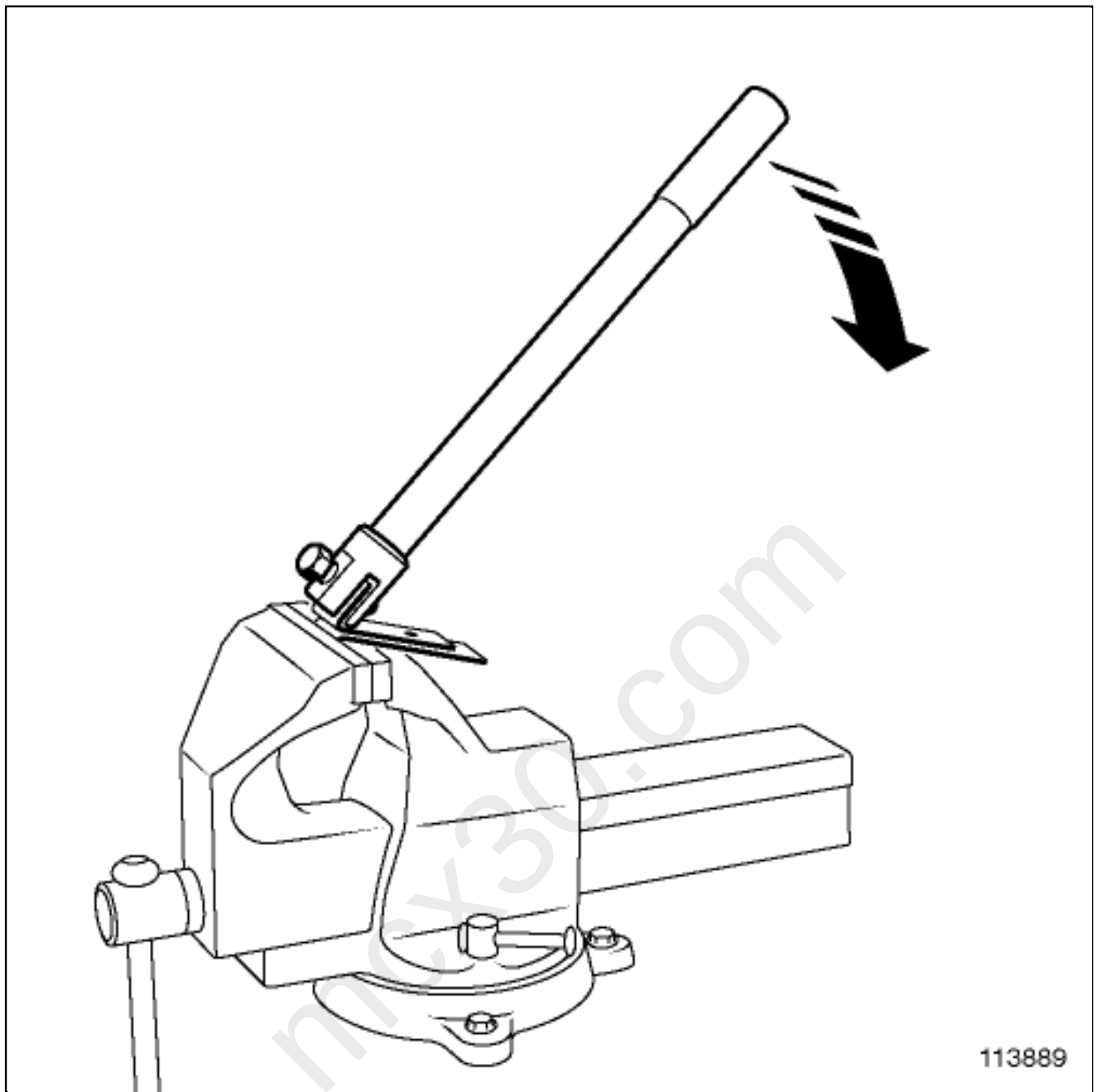


Secure the jaw of the peeling tool.



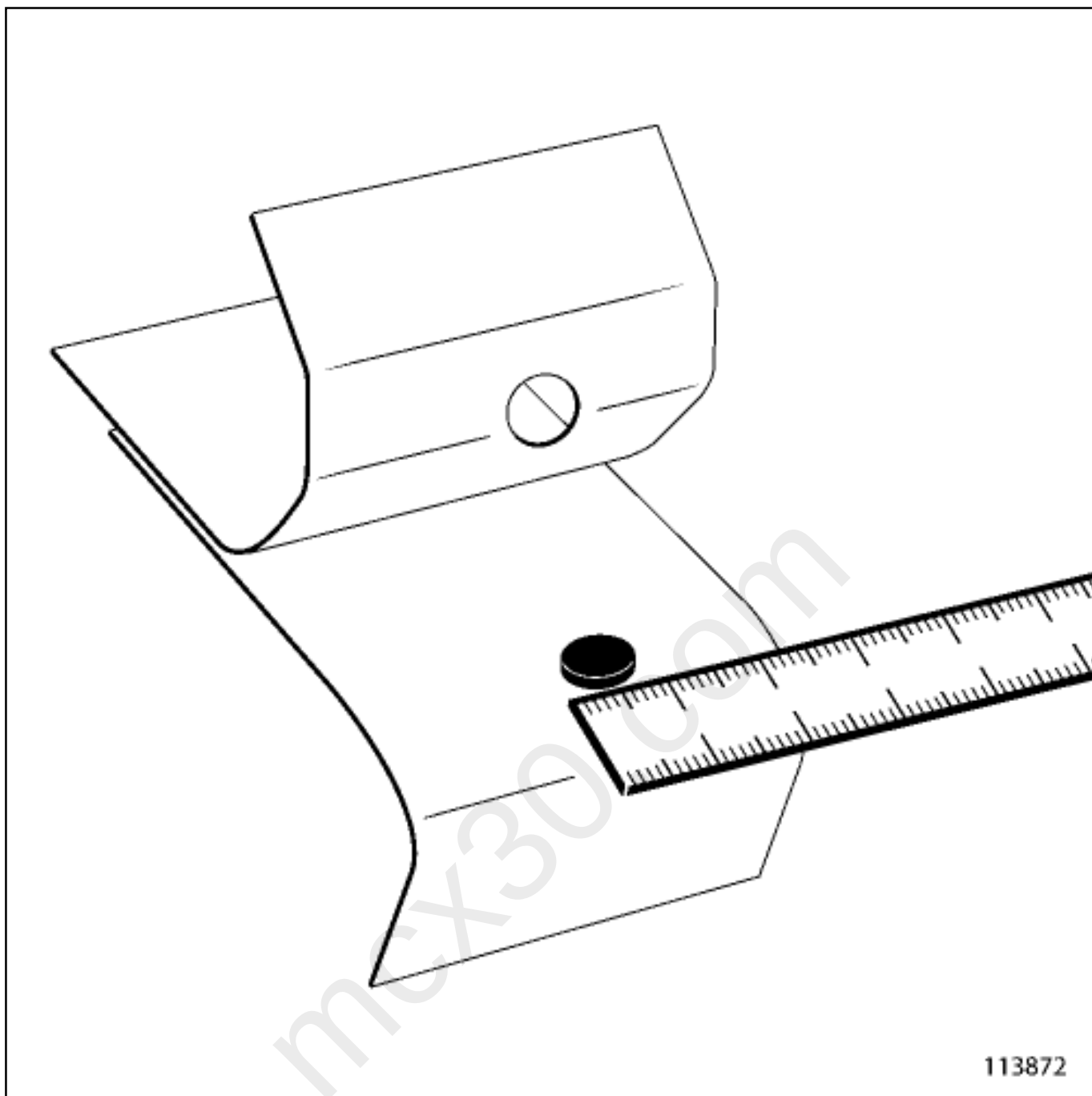
WARNING

To avoid any accidents, tighten the jaw of the tool to prevent slipping during peeling.



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Peel the assembly, applying continuous pressure.



Interpreting the results: section VI.

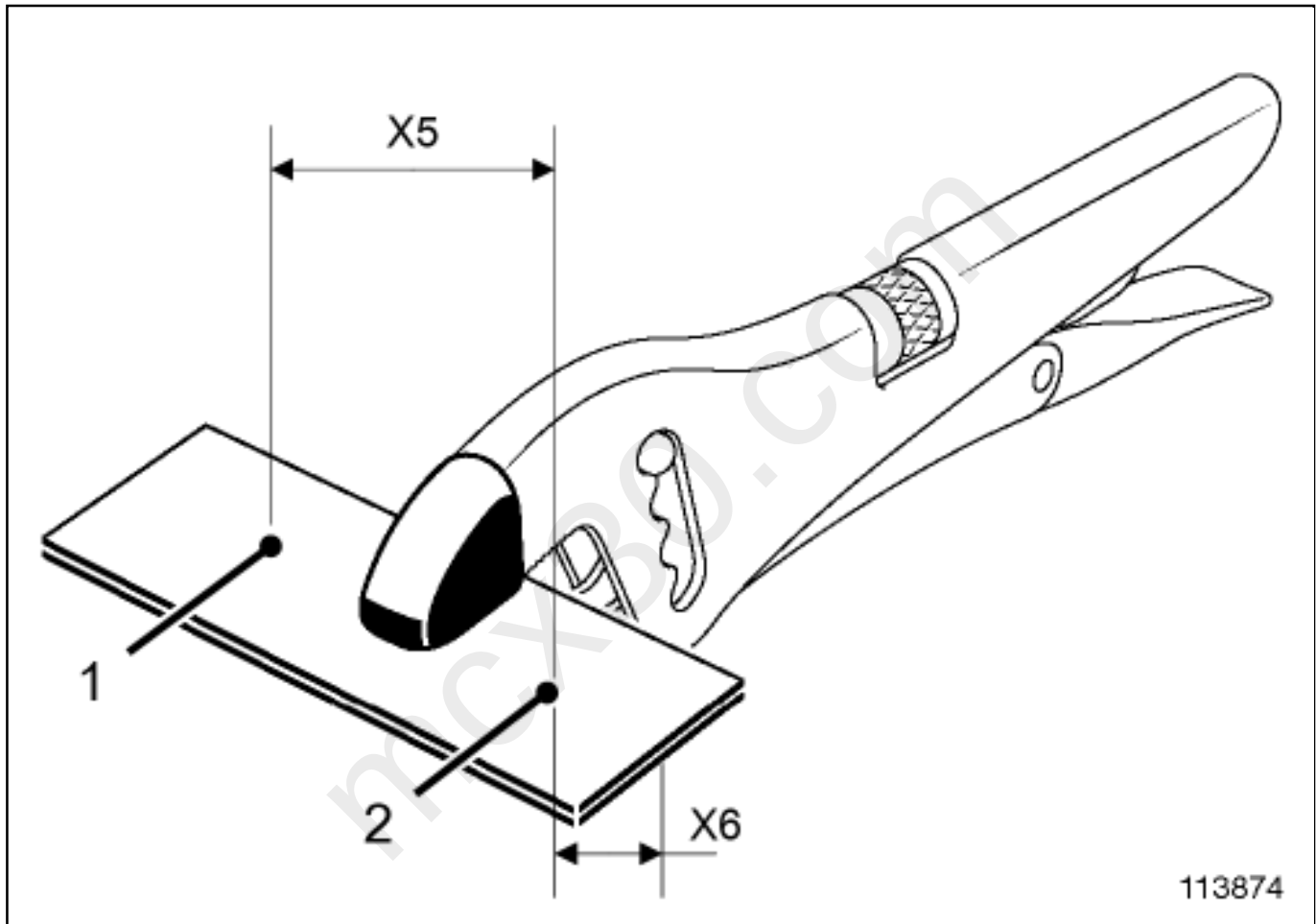
5. PEELING TEST FOR A TRIPLE-THICKNESS ASSEMBLY

Note:



For the test to be valid, carry out exactly the same operations on the vehicle:
first weld two panels, then the third panel.

First confirm the adjustments for the first two panels following the procedure for a PEELING TEST FOR A DOUBLE THICKNESS ASSEMBLY.

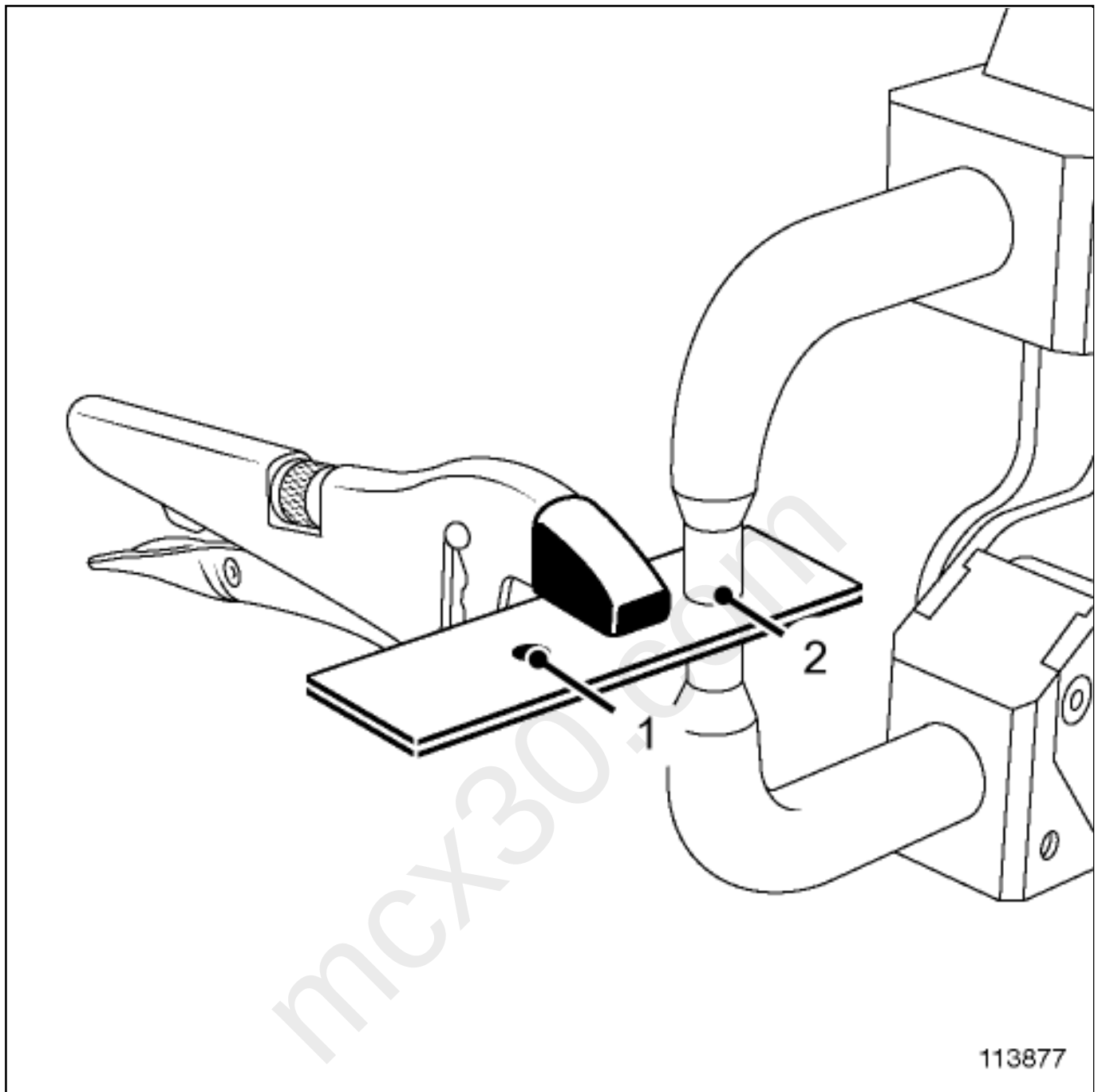


Prepare two test specimens that correspond to the first two panels, respecting the gaps between the spot welds, and aligning them exactly one on top of the other.

Position values of the spots:

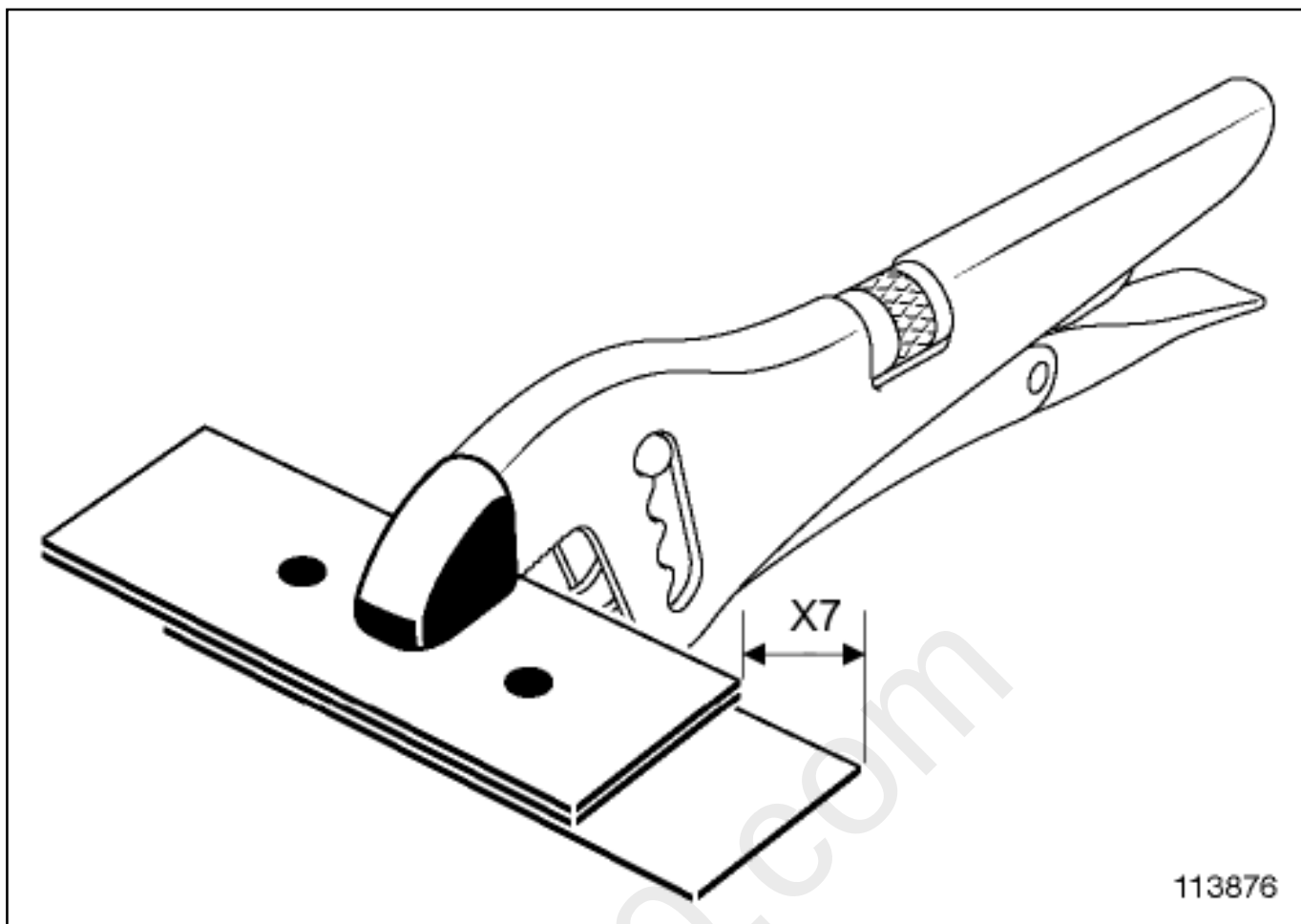
(X6) = 20 mm,

(X5) = 40 mm minimum.



Make the holding spot(1) .

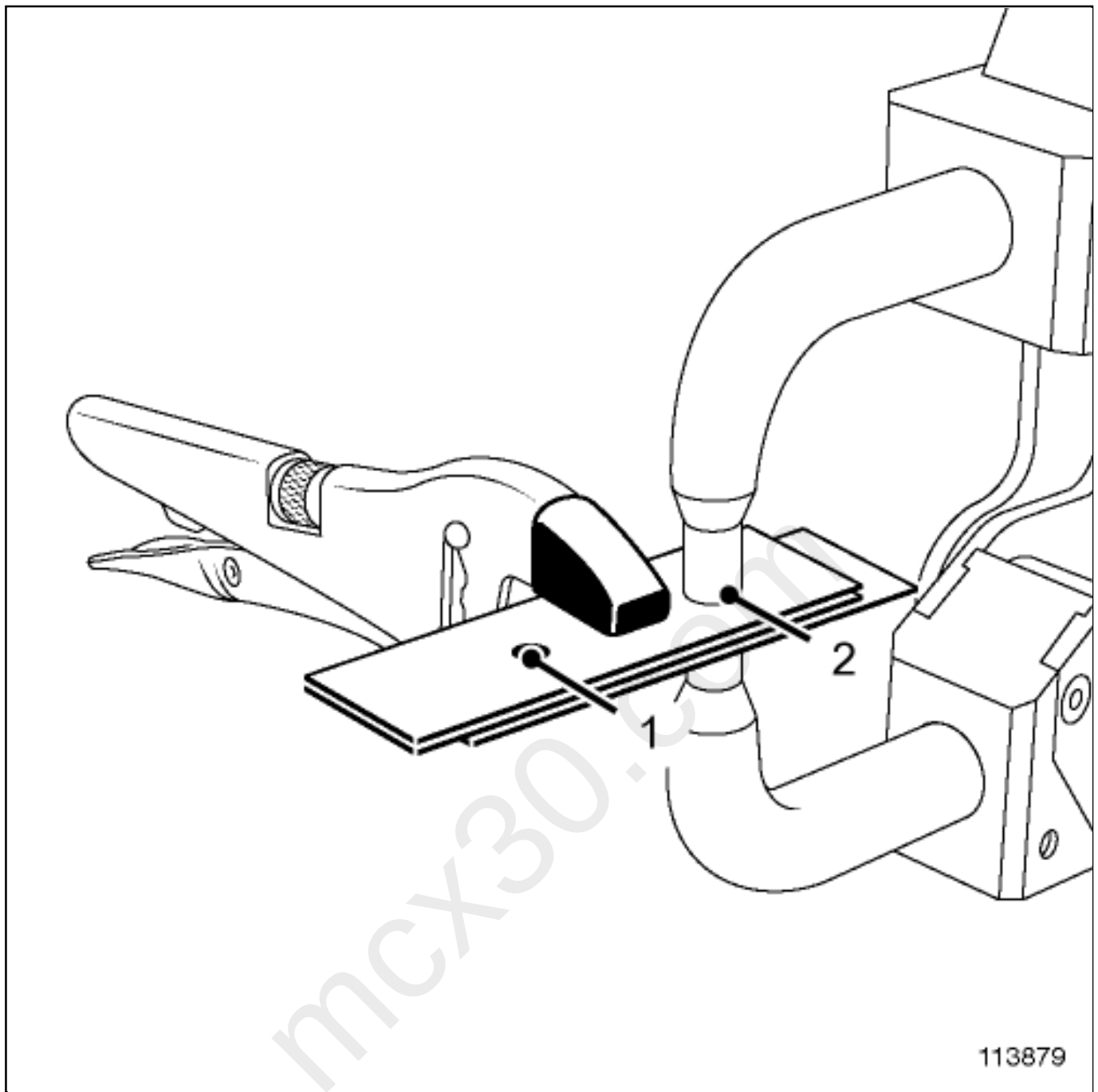
Make the peeling spot(2) , keeping to the predefined adjustments.



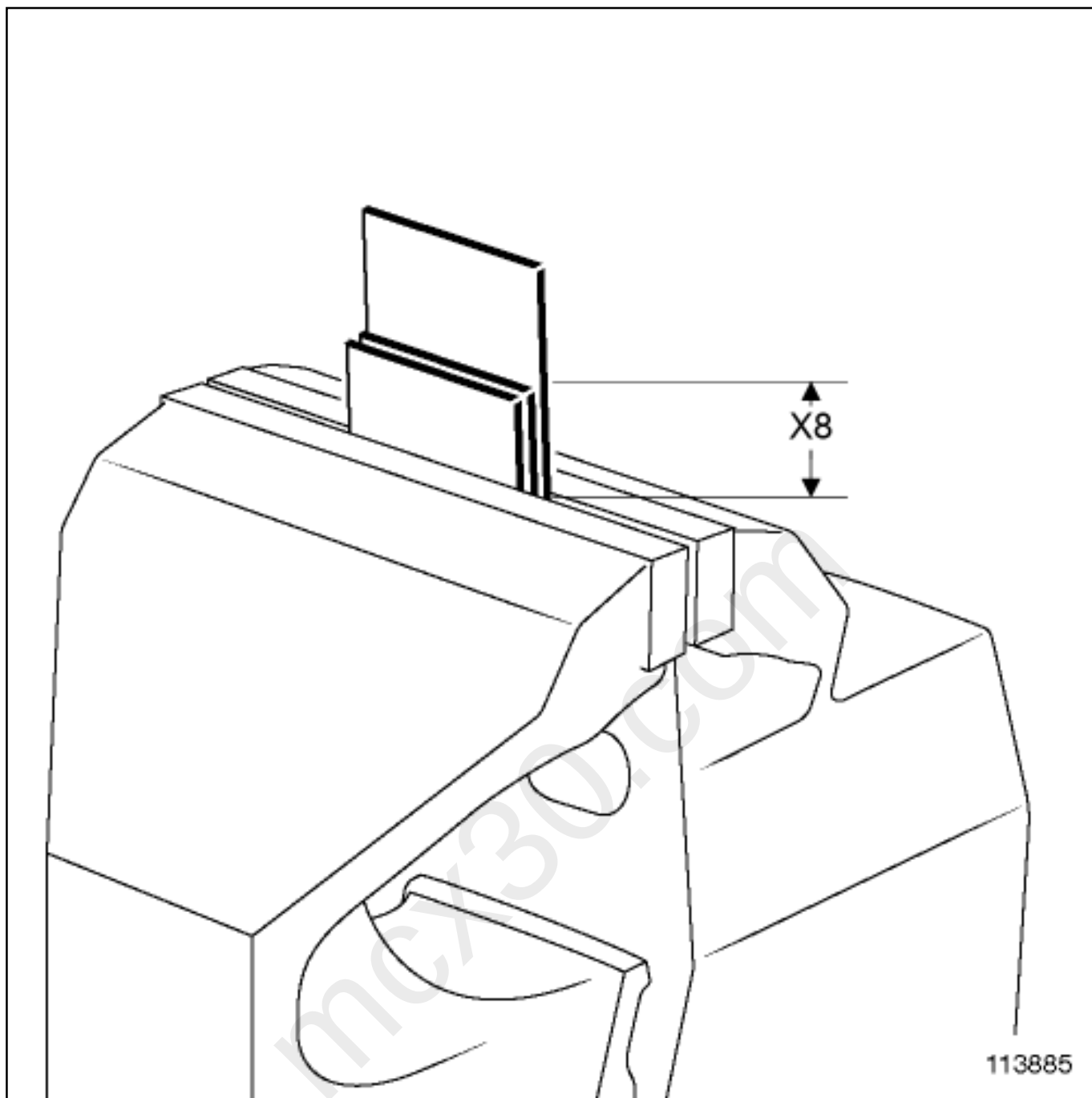
Position the third panel, respecting the stack order (thickness/grade).

Offset the latter by(x7) = 20 mm.

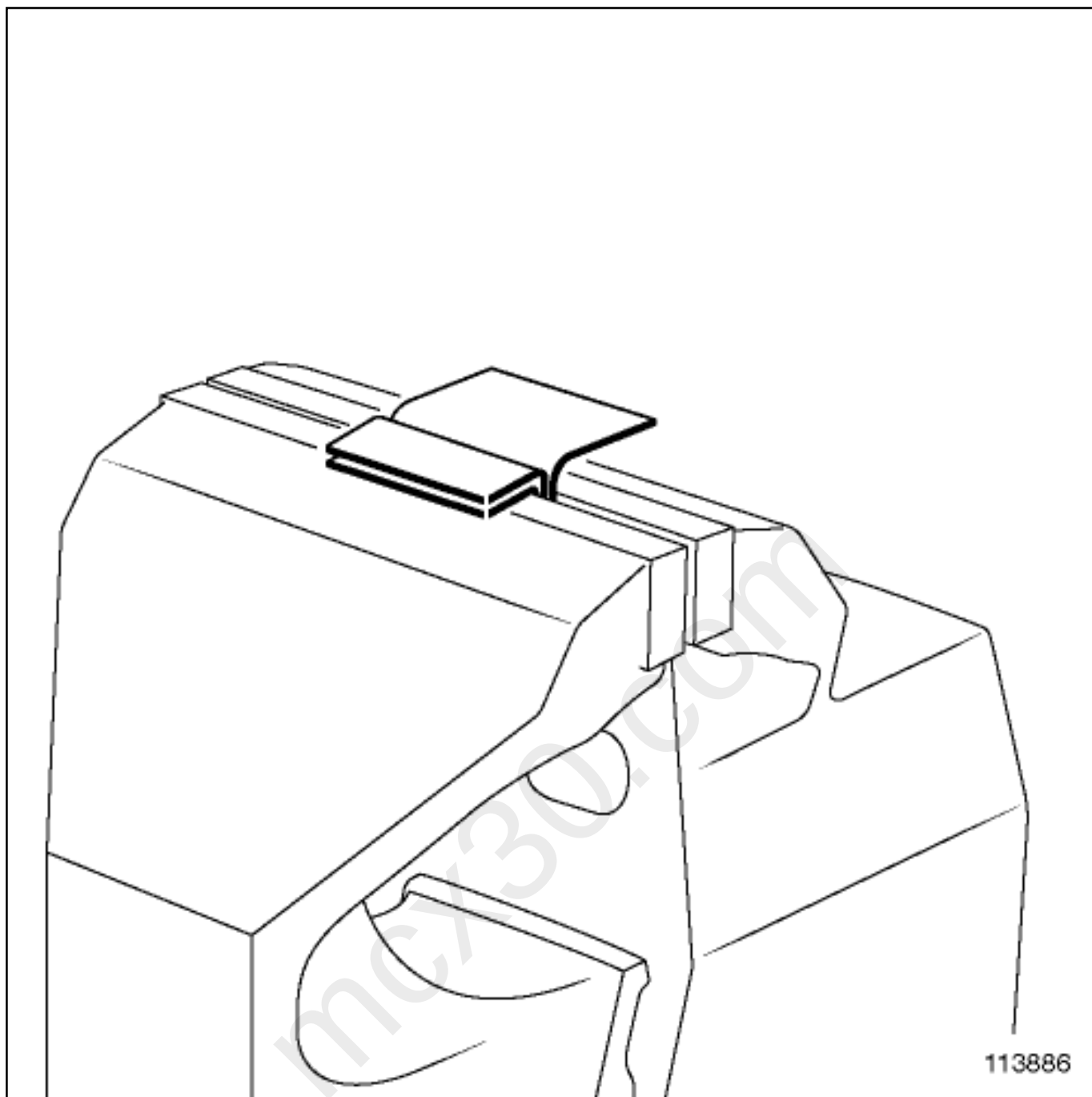
Secure it using separate locking pliers.



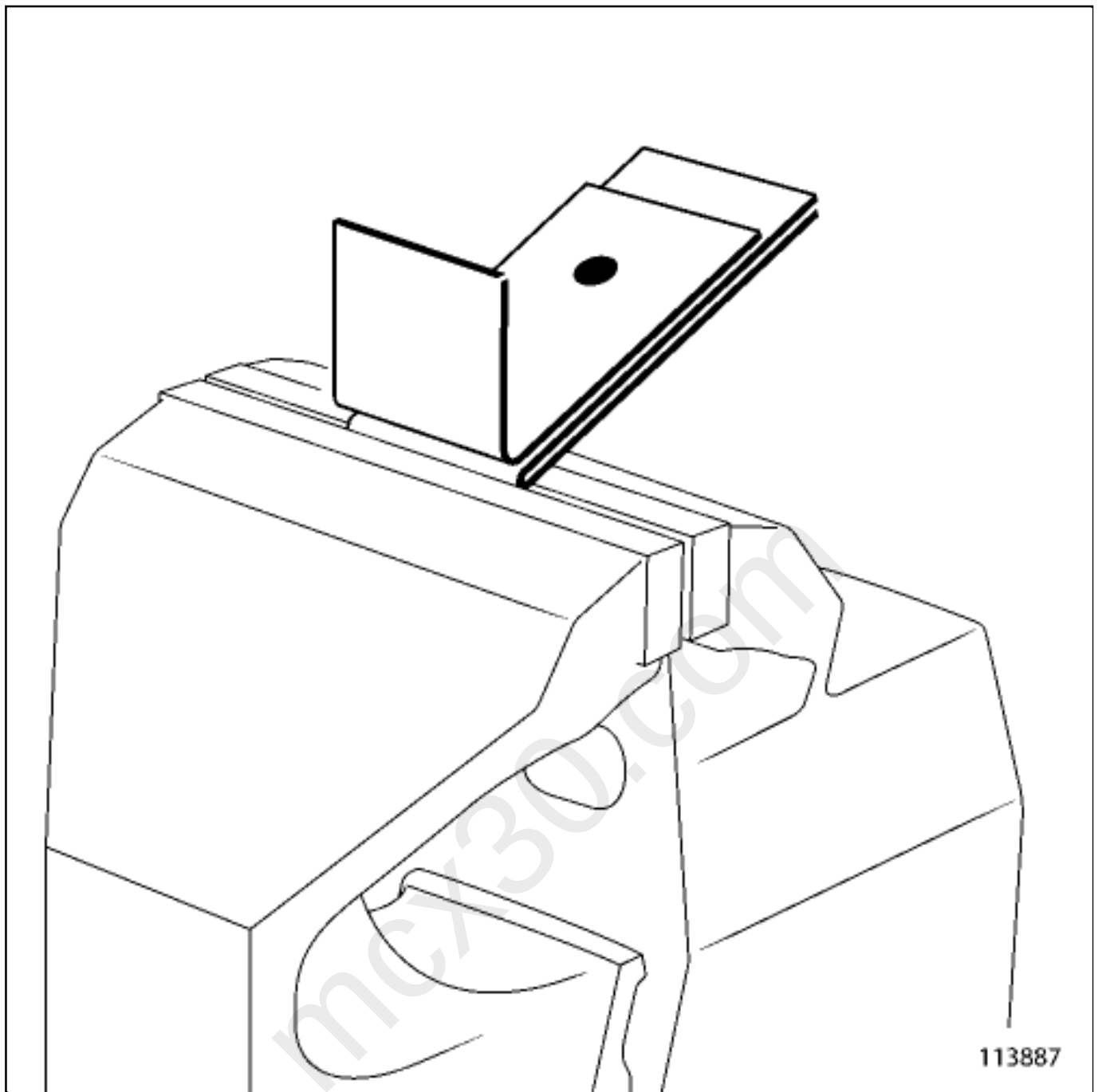
Make the spot welds(1) and (2) over the existing spots on the first two panels.



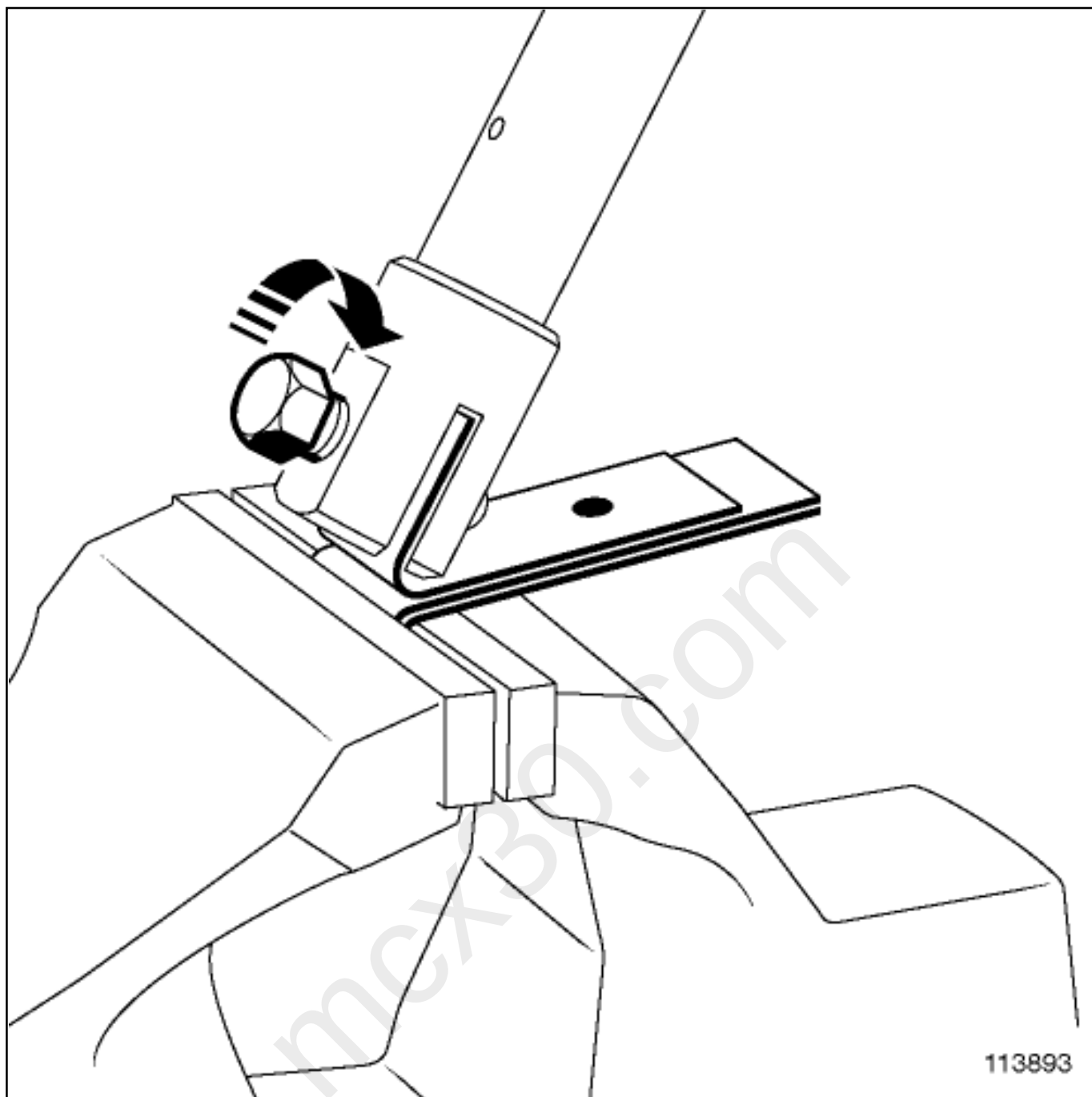
Secure the test specimens in the vice, respecting the dimension(x8) = 15 mm.



Fold down the test specimens, as shown in the illustration.



Secure the test specimens in the vice.

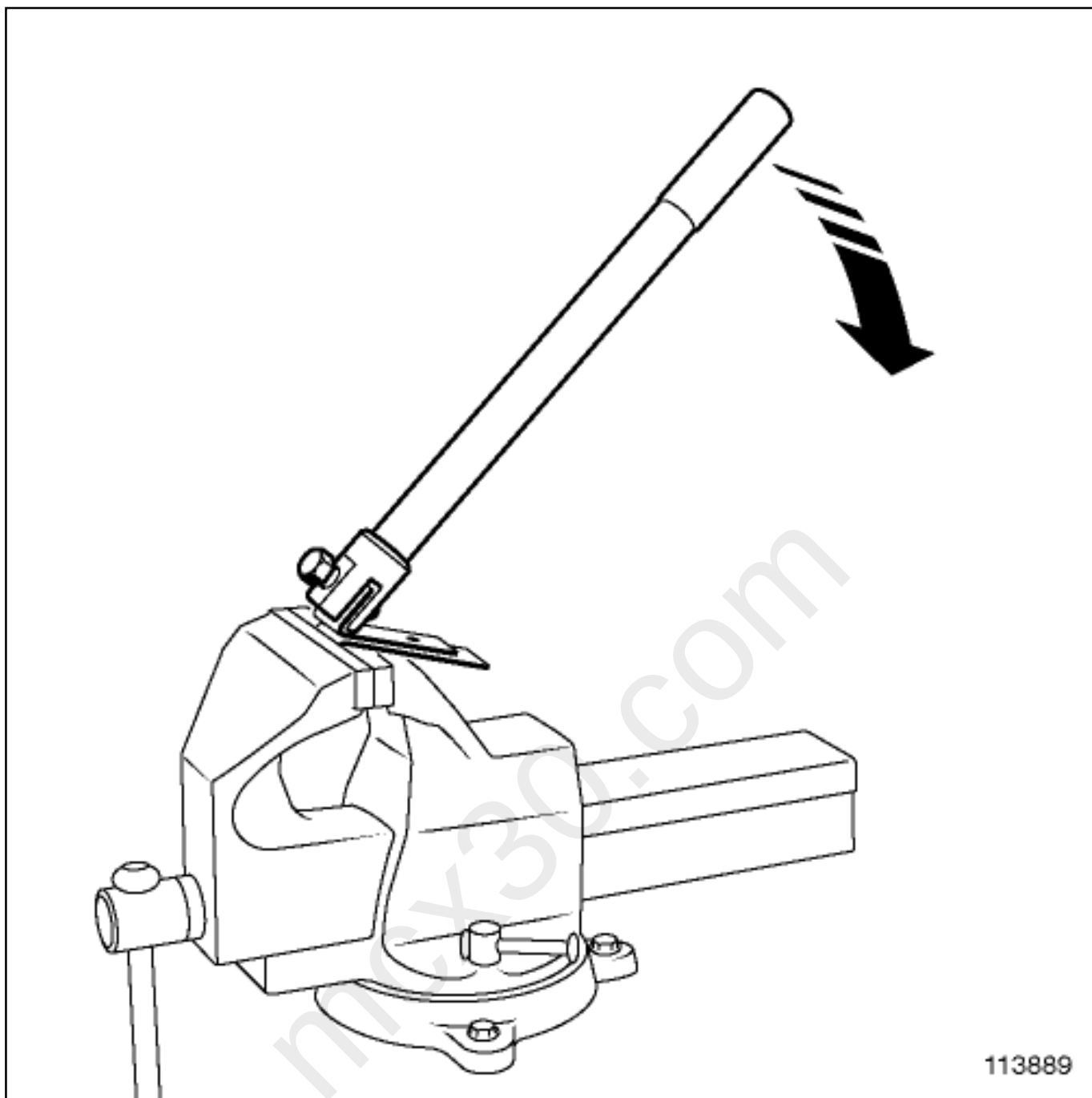


Secure the jaw of the peeling tool.

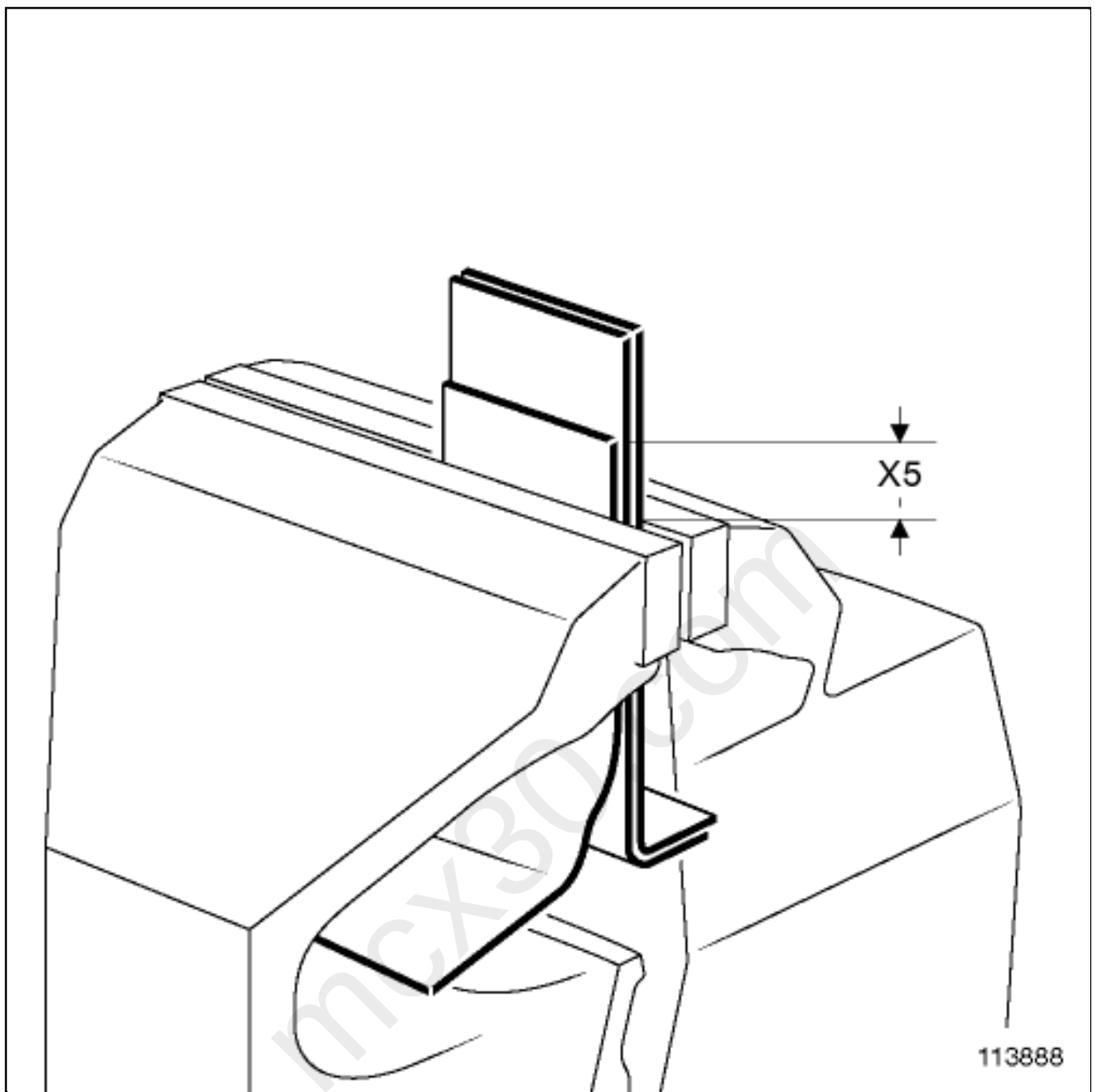


WARNING

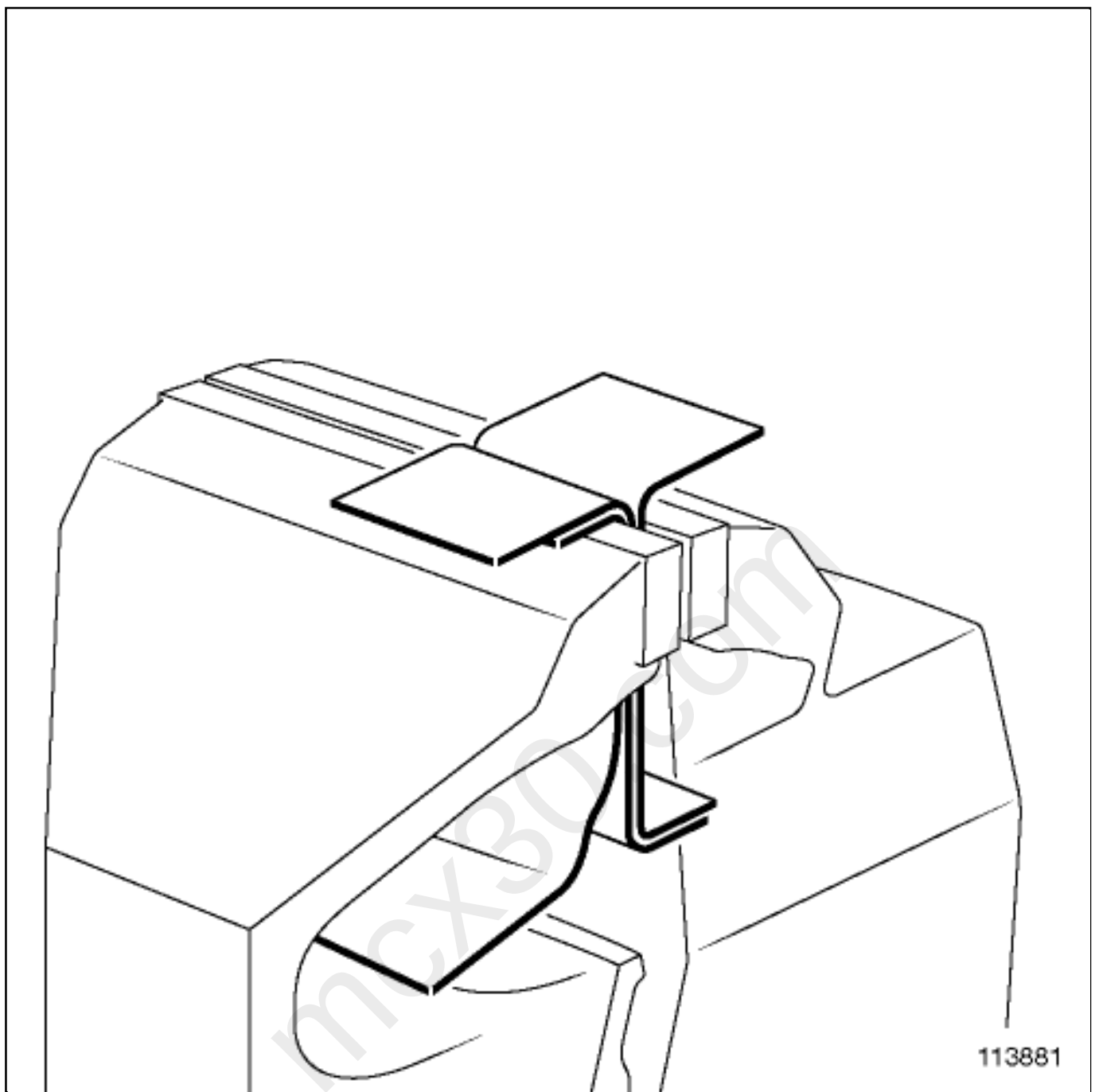
To avoid any accidents, tighten the jaw of the tool to prevent slipping during peeling.



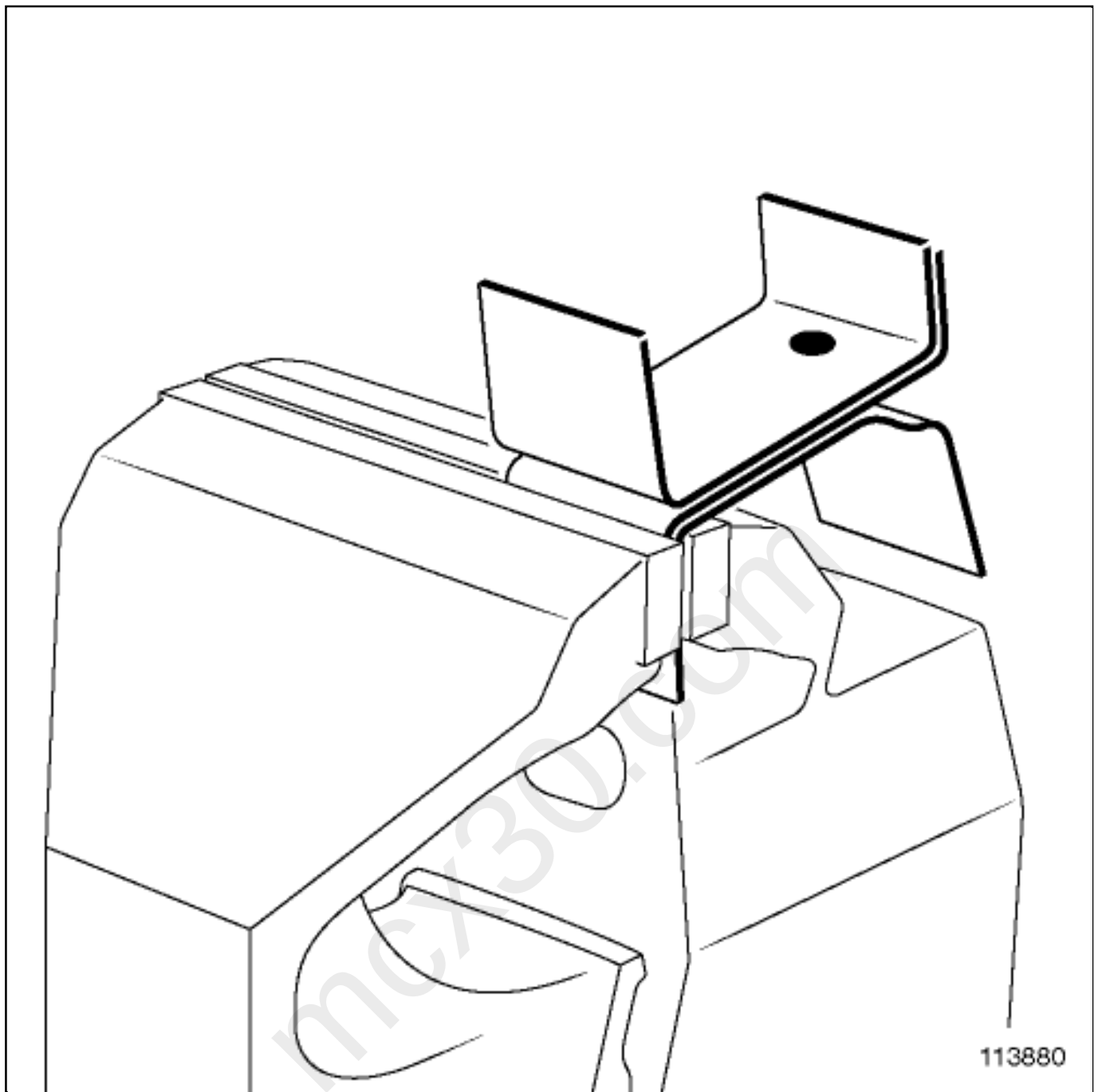
Peel the assembly, applying continuous pressure.



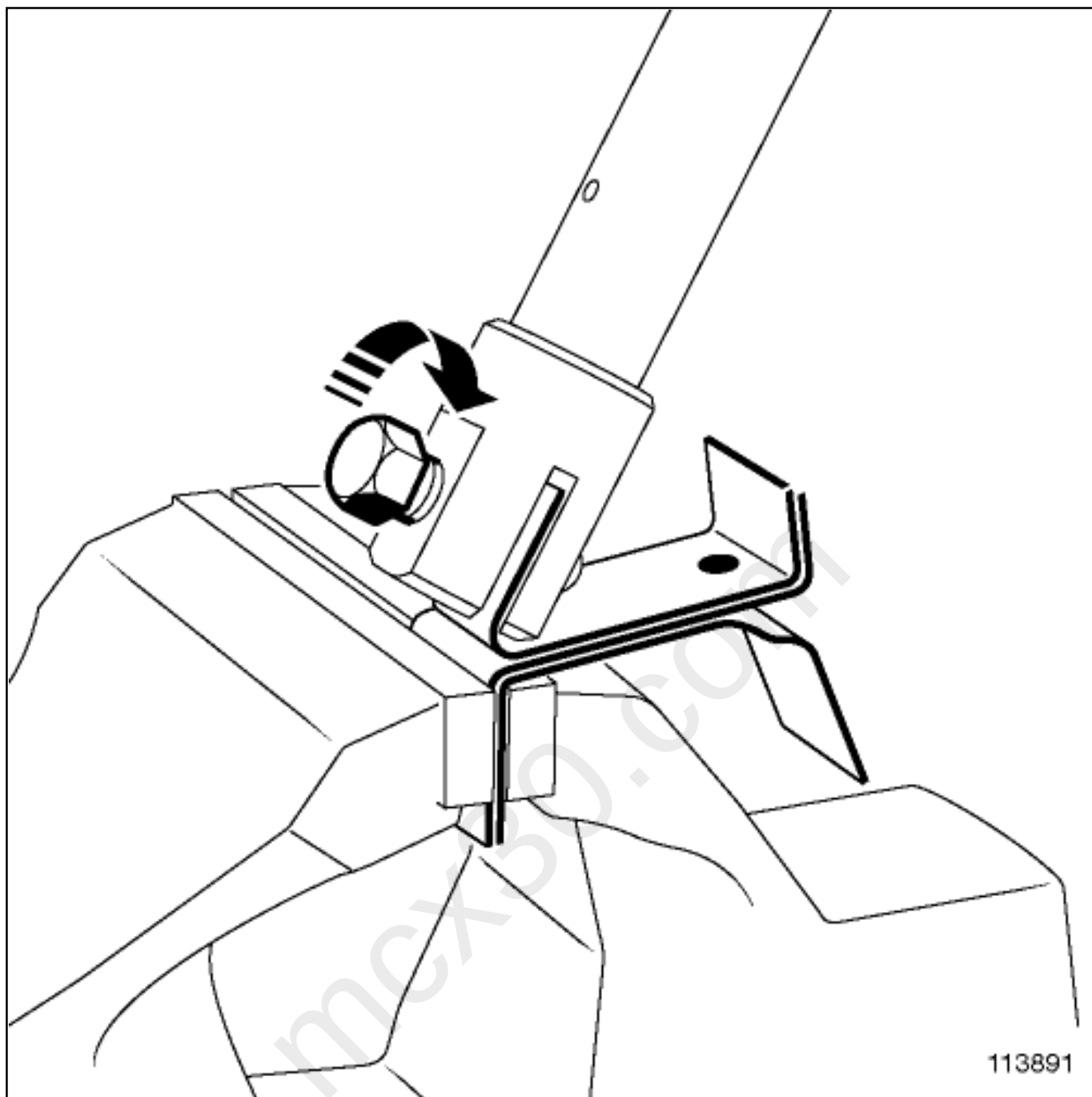
Re-secure the test specimens in the vice(x5) = 15 mm.



Fold down the test specimens, as shown in the illustration.



Secure the test specimens in the vice.

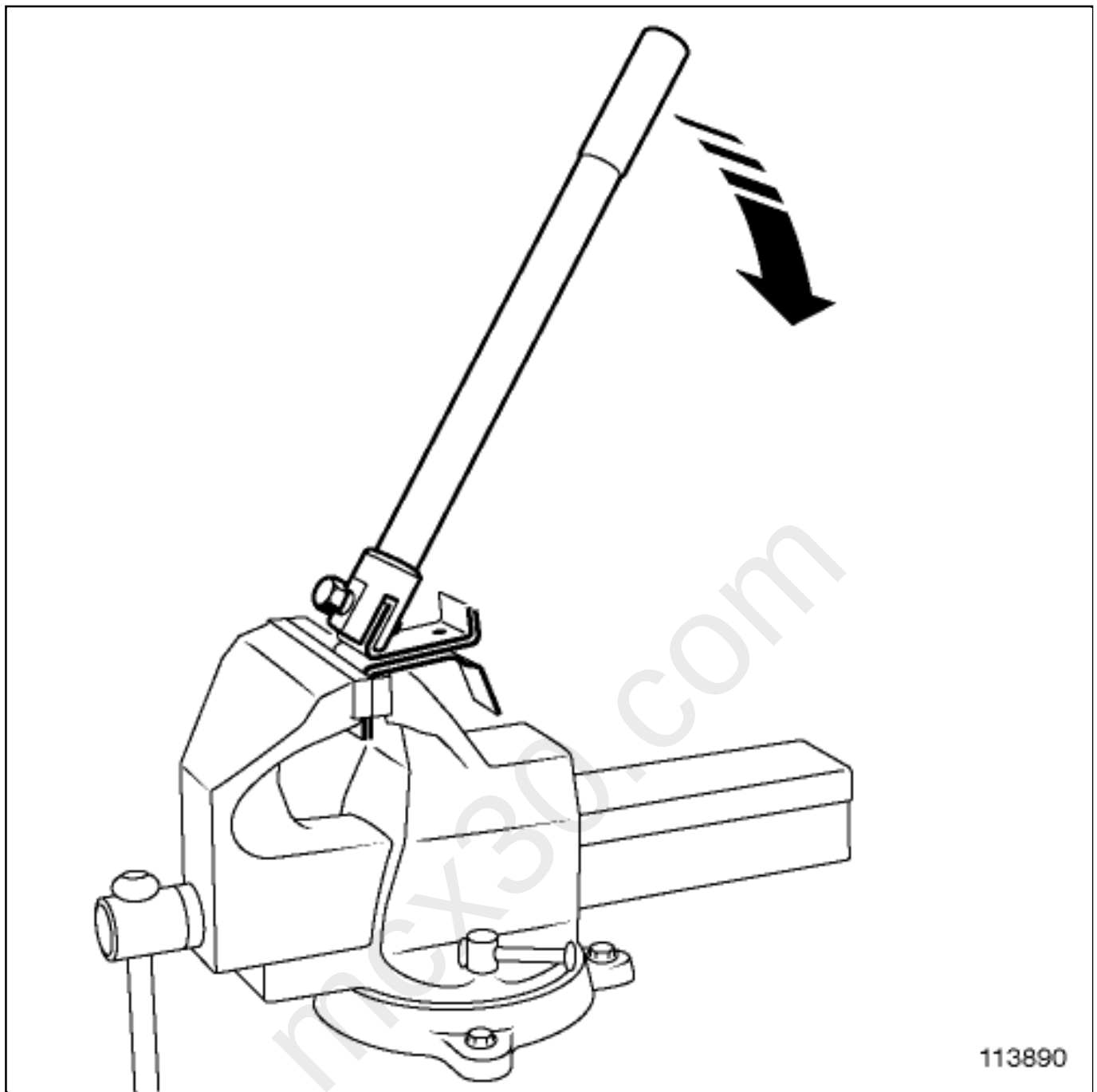


Secure the jaw of the peeling tool.



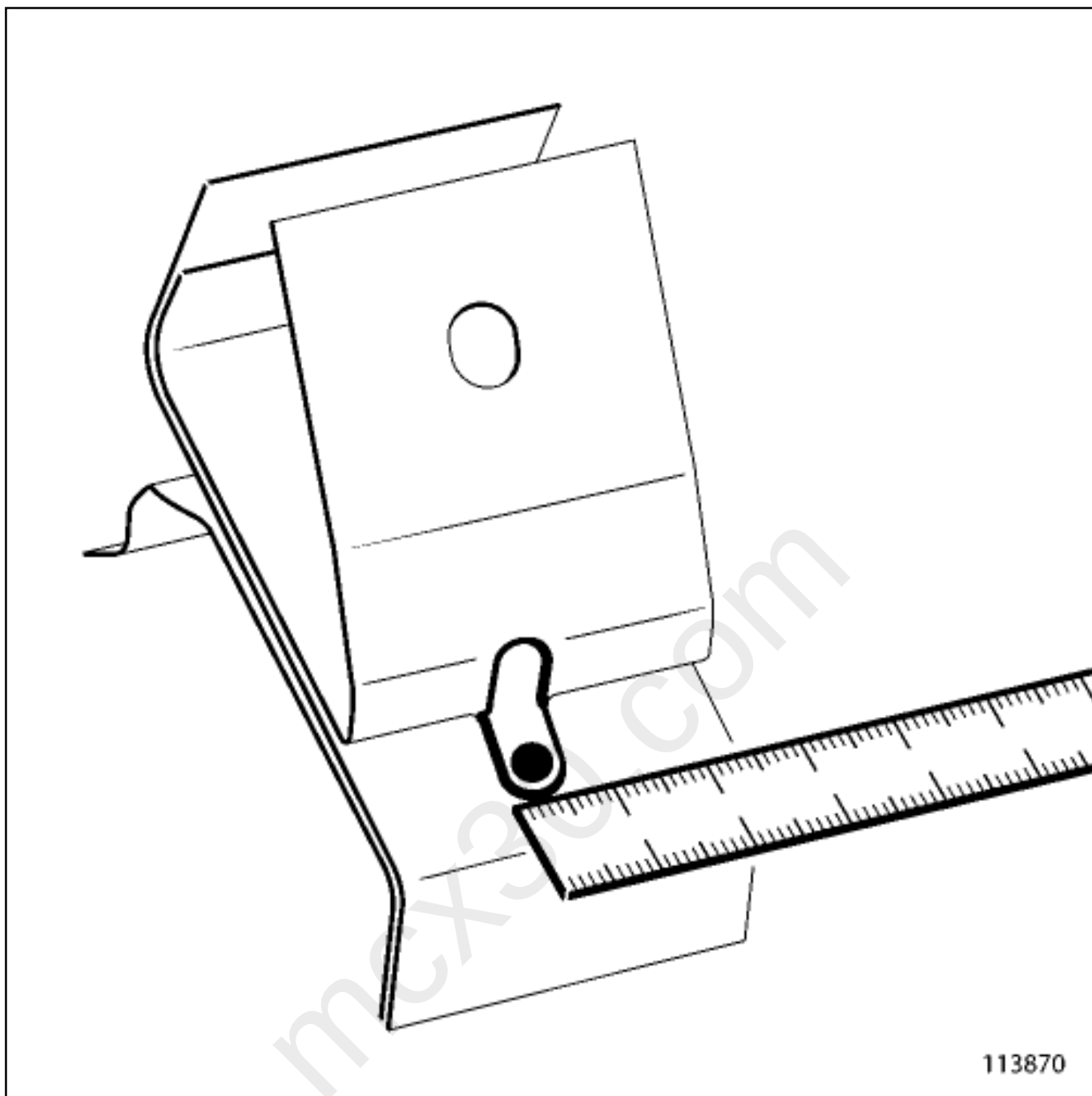
WARNING

To avoid any accidents, tighten the jaw of the tool to prevent slipping during peeling.



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Peel the spot weld of the first joint, applying continuous pressure.



Interpreting the results: section VI.



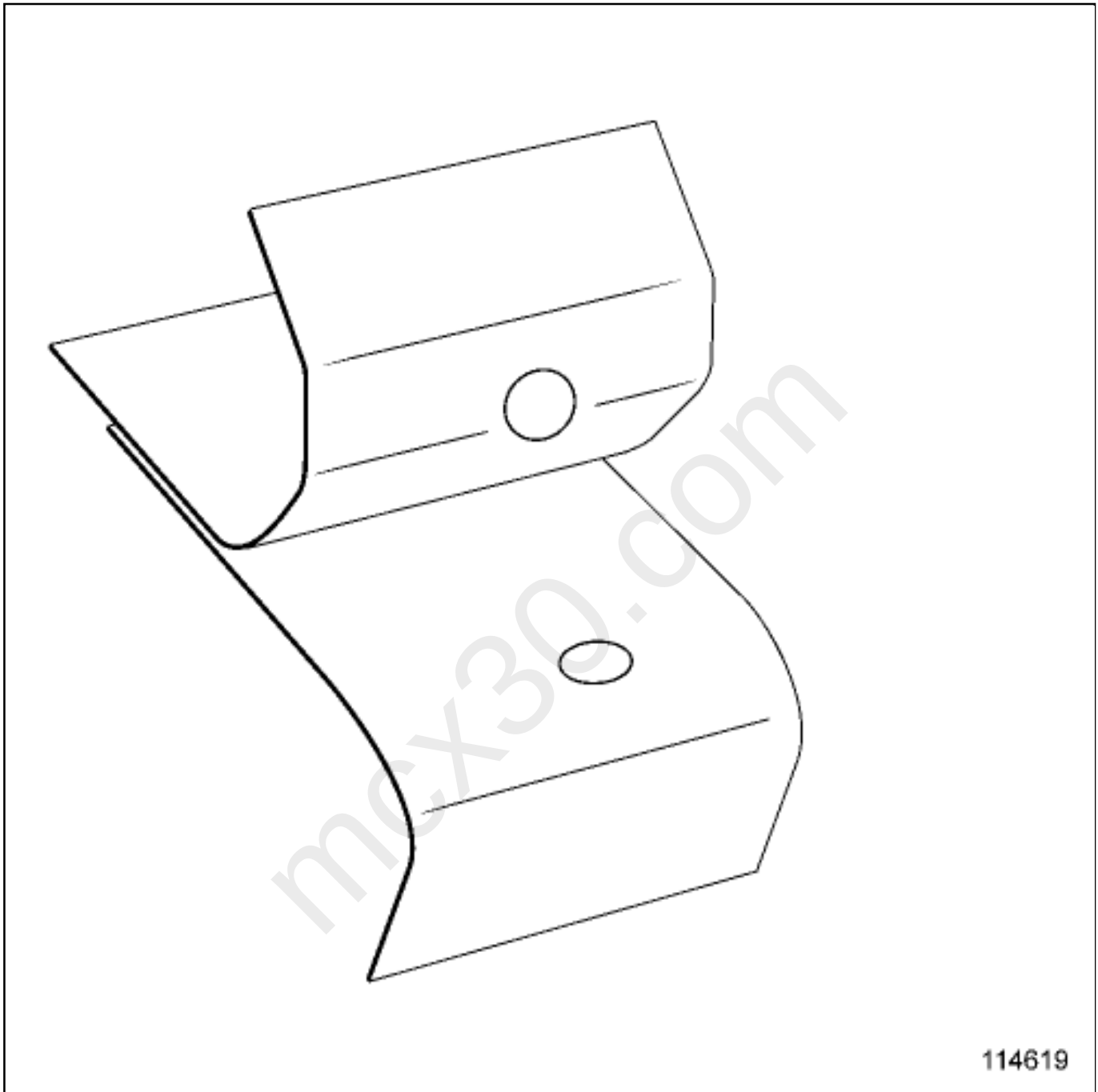
Note:

For triple-thickness assemblies, the thinnest panel on each side of the stack must always be taken into account in order to determine the right material rivet.

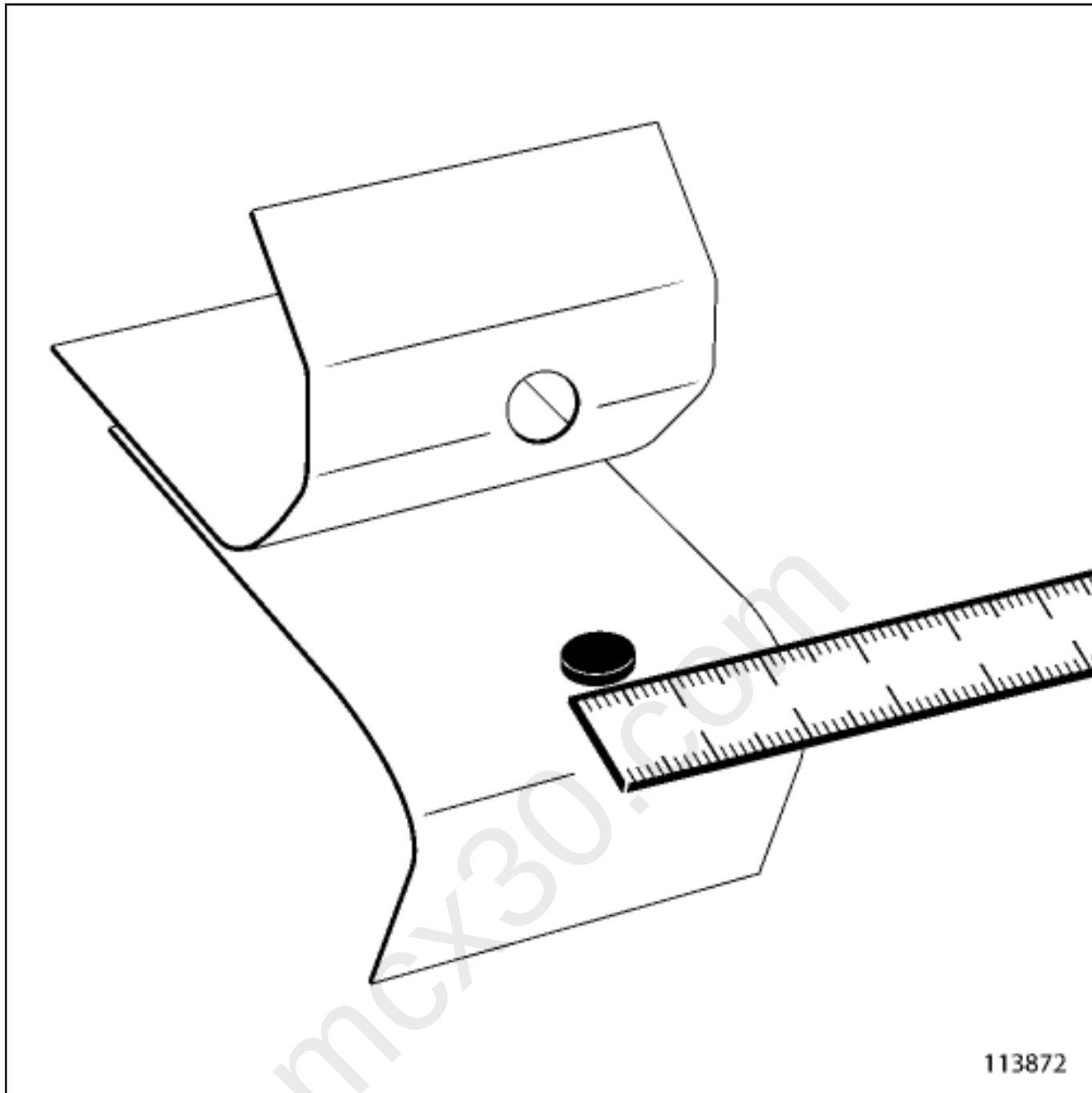
This test is based on the presence or absence of a material rivet after peeling of the spot weld.

1-POSSIBLERESULTS

CEMENTED SPOT: UNACCEPTABLE

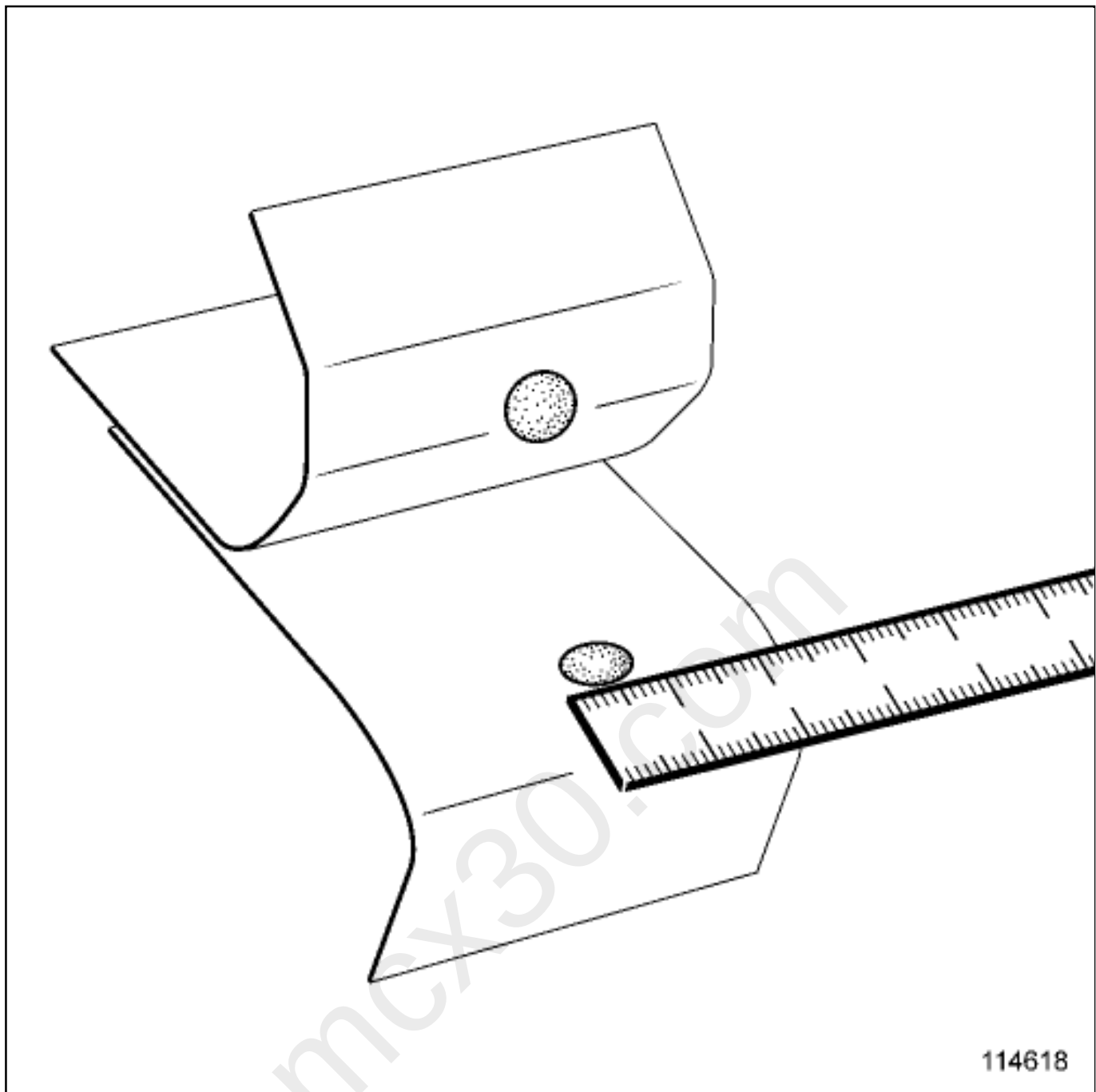


SPOT WITH MATERIAL RIVET: ACCEPTABLE, IF DIAMETER SUFFICIENT



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SPOT WITH MATERIAL PULLING OFF: ACCEPTABLE, IF DIAMETER SUFFICIENT (SEE FOLLOWING TABLE)



Note:



On thick, very high/ultra high elastic limit steels, there may be no material rivet, but material pulled off at the interface; this type of spot weld is acceptable: measure the diameter of the pulled off zone and compare it to the table of values.

Check that the diameter of the material rivet meets the criteria in the following table, with regard to the reference thickness.

Thickness (thinnest panel)	Minimum diameter required
between 0.77 mm and/or equal to 1.2 mm	4 mm
between 1.2 mm and/or equal to 2 mm	6 mm
between 2 mm and/or equal to 3 mm	8 mm

2-



If the result is good:

-
- Apply the parameters for the joints on the vehicle,
- Carry out the vehicle tests: part IX.



If the result is incorrect (cemented spot, material rivet too small):

-
- Apply the remedies: part VII

7. REMEDIES



Factors leading to a poor result:

-
- Poor electrical and pneumatic conditions.
- The machine does not meet the required performance levels.
- Change of electrode holder.

If Effort cannot be guaranteed: increase Time and reduce Current.

If Current cannot be guaranteed: increase Time and reduce effort.

2- CHECKING ADJUSTMENTS



Note:

After any setting adjustments, the resistance spot weld must first be confirmed on a sample using the peeling test in section IV.



If the result is good:



Apply the parameters to the vehicle,



Carry out the vehicle tests: part IX.



If the result is incorrect (cemented spot, material rivet too small):



Apply the replacement solutions: section VIII.

8. REPLACEMENT SOLUTIONS

1- LONG TIME TABLE

If adjusting the parameters does not achieve good results, use the following table only on panelwork parts, and selectively on structural parts:

Grades	Thickness of reference panel	Current (A)	Time (ms)	Effort (daN)
Mild steel	0.7 mm	7000	600	250
	1 mm	7400	600	250
HEL steel	0.85 mm	7600	600	250
	1.5 mm	8000	600	250
Very high/ultra high elastic limit steel	1.5 mm	8600	700	250
	2.5 mm	8600	900	250

Note:



This is an exceptional case which cannot be applied generally to the whole of the repair.

In the same way as an RSW spot defined in the first chart, the RSW spot must be confirmed in advance on a sample with the peeling test from section IV.

2- PLUG WELDS

If adjusting the parameters does not achieve good results, or if access is a problem, use electric welding with gas shield selectively and on all thicknesses, making plug welds.

(see 40C, Gas metal arc welded connections, Connections by arc welding under shielding gas: Precautions for the repair)

Note:



This is an exceptional case which cannot be applied generally to the whole of the repair.

In the same way as an RSW spot, a plug weld spot must be confirmed in advance on a sample with the peeling test from section IV.

9. VEHICLE TESTS

